American Chemical Service NPL Site
Griffith, Indiana

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Region 5

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Cover photograph shows the open-water pond constructed during completion of the removal of PCB-impacted sediments from the Site wetland area (Section 4.1.4).

MWH

September 2005

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1.0 INTRODUCTION

This Report has been developed to document the Remedial Actions that have been completed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) at the American Chemical Service (ACS) National Priorities List (NPL) site located in Griffith, Indiana.

This remedial action report formally presents the construction, cost, and performance information for the ACS NPL Site located in Griffith, Indiana. Guidance was incorporated from "Close Out Procedures for National Priorities List Sites" Office of Emergency and Remedial Response, U.S.EPA 540-R-98-016, 3 January 2000.

The site history and completed Remedial Actions (RA) are summarized in the following sections.

1.1 SITE LOCATION AND BACKGROUND

The ACS Superfund site is a 33-acre parcel of land, including an active chemical manufacturing plant located at 420 S. Colfax Avenue, in Griffith, Indiana. ACS began as a solvent recovery facility in May 1955. Solvent mixtures containing alcohols, ketones, esters, chlorinated hydrocarbon compounds, aromatic compounds, aliphatic compounds, and glycols were accepted by ACS and "reclaimed" by distillation. Many of the compounds had been used as cleaning solvents and so they contained various residual materials. ACS has also operated a series of batch chemical processes at various times during its history. Other processes conducted at the site include epoxidation and bromination operations, and storage and blending of waste-streams for ACS' secondary fuel program. ACS ceased solvent reclaiming activities in 1990 after losing interim status under the Resource Conservation and Recovery Act (RCRA). ACS currently operates as a chemical manufacturer.

Land around the site is primarily used for industrial purposes. There are also several single-family residences nearby. Colfax Avenue borders the site on the east. A rail spur owned by ACS (formerly a set of four tracks owned by the Chesapeake and Ohio railway) bisects the site in aN east-west direction, between the fenced On-Site Area and the fenced Off-Site Area. Further to the west, south of the rail spur, the site is bordered by the abandoned Erie and Lackawanna railway and the active portion of the Griffith Municipal Landfill. West of the ACS facility and north of the rail spur the site is bordered by wetlands. The northern boundary of the site is formed by the Canadian National railway (formerly the Grand Trunk railway).

In the late 1960s and early 1970s, small batches of chemicals were manufactured at ACS. Two on-site incinerators burned still bottoms, non-reclaimable materials generated from on-site production and off-site wastes. The first incinerator started operating in 1966, the second in 1968, and together burned approximately two million gallons of industrial waste per year. The incinerators were dismantled in the 1970s.

Several areas on the ACS property were used for disposal of hazardous substances. These disposal areas were identified as potential source areas by the United States Environmental Protection Agency (U.S. EPA) and named: 1) the Still Bottoms Pond Area (SBPA); 2) Treatment Lagoon #1 and adjacent area; 3) the On-site Containment Area (ONCA); 4) the Off-Site Containment Area (OFCA); and 4) the Kapica/Pazmey (K-P) Area. While the OFCA is owned by ACS, it was named the Off-Site Area because it is separated from the ACS plant by a fence and the rail spur. The Off-Site Area includes the OFCA and the K-P Area. The On-Site Area includes the ONCA, the Still Bottoms Area, Treatment Lagoon #1, and adjacent areas. Figure 1 (page 2) is a site map that illustrates the layout of these On-Site and Off-Site source areas.

Approximately 400 drums containing sludge and semi-solids of unknown types were reportedly disposed of in the ONCA. The Still Bottoms Pond and Treatment Lagoon #1 received still bottoms from the solvent recovery process. The pond and lagoon were taken out of service in 1972, drained, and filled with an estimated 3,200 drums containing sludge materials. The OFCA was utilized principally as a waste disposal area and received wastes that included on-site incineration ash, general refuse, and allegedly a tank truck containing solidified paint, and an estimated 20,000 to 30,000 drums that were reportedly punctured prior to disposal. Hazardous substances were also disposed directly on the K-P Area as part of the drum recycling work conducted there. ACS reportedly

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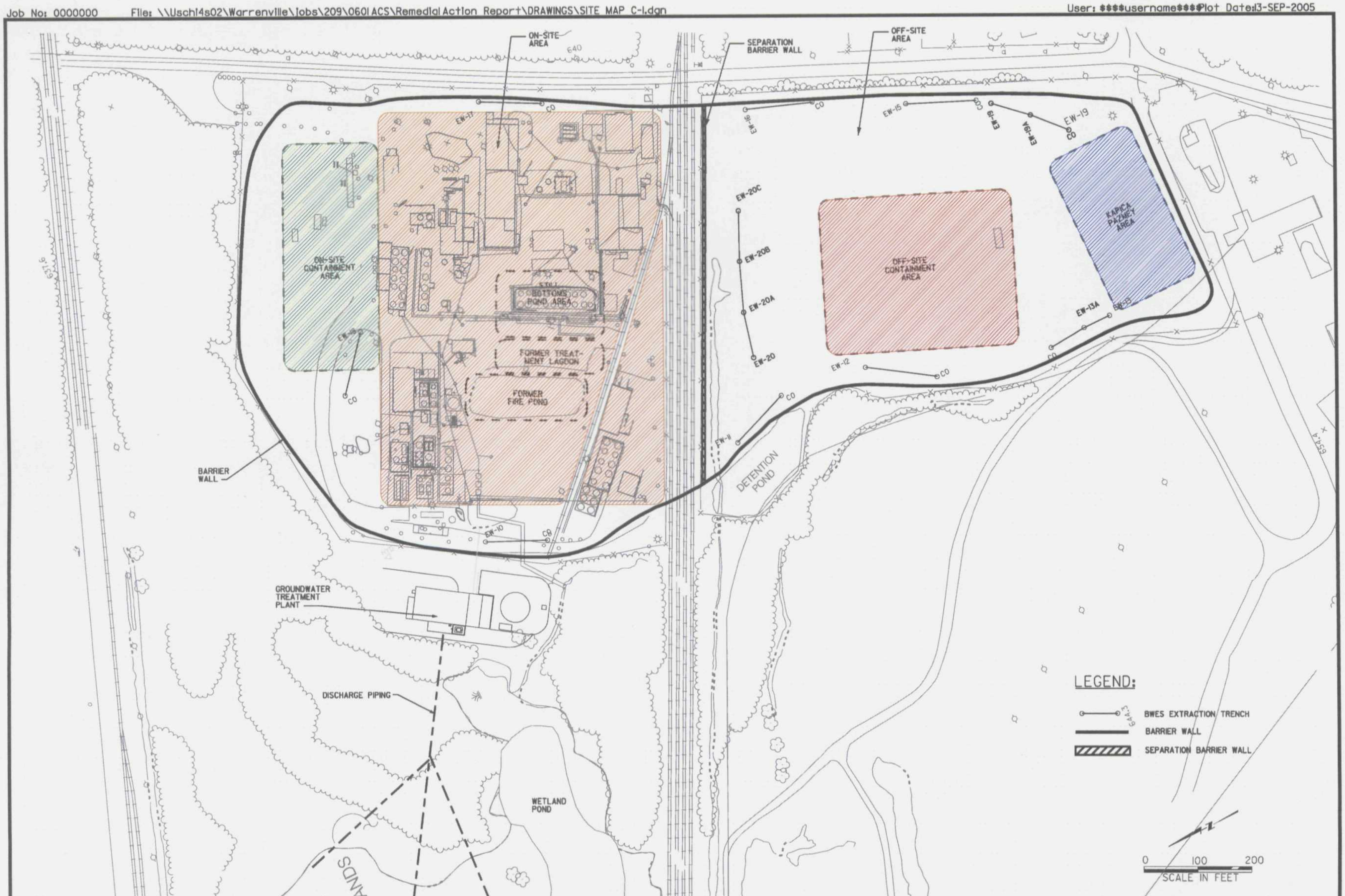


MWH Chicago, Illinois	AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA	REMEDIAL ACTION REPORT SITE PLAN	FIGURE 1

ceased on-site disposal practices in 1975.

ACS was placed on the NPL in September 1984. A Remedial Investigation (RI) was started in 1988 and conducted in three phases. The RI Report, the Baseline Risk Assessment, and a Feasibility Study (FS) were completed in 1992.

The Risk Assessment and Feasibility Study showed that the principle potential threats represented by the ACS NPL Site included buried drums, buried wastes, contaminated soil and debris, contaminated ground water and contaminated surface water. Buried wastes and contaminated soil and debris were identified as a continuing contaminant source to groundwater, a direct contact threat should future excavation occur, and an inhalation threat from migration of volatile contaminants through existing cover material and possible dispersion of contaminants to the neighboring community.

The U.S. EPA issued a Record of Decision (ROD) on September 30, 1992. Pre-Design Investigations were conducted during 1995 and voluntary site stabilization activities were constructed during 1996 and 1997. U.S. EPA issued a ROD modification in July 1999. In addition, U.S. EPA issued an Explanation of Significant Difference (ESD) to the ROD in September 2004.

The remedial action objectives for the ACS Site established in the ROD include the following:

- Minimize exposure to contaminated soil, groundwater, buried drums / liquid wastes / sludges, or other substances which would result in a risk greater than the acceptable risk range identified in the ROD,
- Restore groundwater to applicable state and federal requirements,
- Reduce migration of contaminants off-site through water, soil, or other media, and
- Reduce the potential for erosion and possible migration of contaminants via Site surface water and sediments.

The original ROD (1992) included low temperature thermal treatment (LTTT) as one of the components of the remedy. However, there were concerns regarding the feasibility of such technology for the Site. Therefore, a series of Pre-Design Investigations were conducted to evaluate the viability of the remedy and establish design criteria for the components of the remedy. The following voluntary interim actions were taken to stabilize the Site and further inhibit off-site migration of contaminants during the time it would take to complete the Pre-Design Investigations and the Remedial Design:

- Installation of a barrier wall around approximately 30 acres including the On-Site and Off-Site Areas, keyed into the clay beneath the upper aquifer at a depth of 20 to 30 feet below ground surface. The purpose of the barrier wall was to isolate the buried waste and eliminate the primary source of groundwater contamination in the upper aquifer.
- Installation of the Barrier Wall Extraction System (BWES) to control the groundwater levels inside the Barrier Wall.
- Installation of a Perimeter Groundwater Containment System (PGCS) along a 1,500-foot zone north and west of the ACS facility to further inhibit off-site migration of contaminants in the groundwater and to eliminate discharge of contaminated groundwater from the upper aquifer into the wetlands.
- Construction of the Groundwater Treatment Plant (GWTP) to treat the groundwater extracted from the BWES and PGCS to meet cleanup standards designated by the Indiana Department of Environmental Management (IDEM) and U.S. EPA.

The 1999 modification to the ROD changed the general site approach from primarily a waste treatment remedy to one that uses combined technologies of containment, removal, and treatment. The requirement to treat the buried waste by LTTT was removed from the remedy based on the results of the pre-design technical evaluation, and the PGCS, the barrier wall, the BWES, and the site covers were added as components of the Final Remedy. The Final Remedy was designed to achieve: 1) source removal and mass reduction; 2) treatment of process wastes; and 3) containment of wastes. The following specific components of the Final Remedy accomplish these tasks:

- Containment by the barrier wall and the PGCS,
- ISVE in the SBPA (source reduction through treatment and prevention of vapor migration),
- ISVE in areas of volatile organic compound (VOC) impact in the

OFCA (source reduction through treatment and prevention of vapor migration),

- ISVE in the K-P Area (source reduction and prevention of vapor migration),
- Installation of an engineered cover over the areas containing buried waste (containment and prevention of direct contact with impacted soil and with vapors),
- Removal of Polychlorinated Biphenyl (PCB)-impacted sediments in the wetland areas by excavating and disposing of sediments appropriately,
- Removal and off-site disposal of the intact drums in the ONCA,
- Continued groundwater pumping from the PGCS and BWES and treatment in the GWTP in accordance with the performance standard verification plan (PSVP),
- Active treatment and monitored natural attenuation (MNA) for groundwater outside the barrier wall in the North and South/Southeast Areas,
- Long-term groundwater monitoring in accordance with the Agency-approved groundwater monitoring program, and
- Private well sampling, in accordance with the Agency-approved groundwater monitoring program.

Figure 2 (page 5) illustrates an overall remedial action plan for the ACS Site, highlighting the various remedy components. Since this remedy may result in hazardous substance remaining on-site above health-based levels, a review will be conducted at least every five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Remedial Design was conducted between 1997 and 1999. The Remedial Construction was initiated with the emplacement of the Barrier Wall in 1997 and the major components of the Remedy were completed in September 2004 with the installation of the SBPA asphalt cap. Some further construction activities were continued during 2005 and some will continue for several more years. The construction schedule was complex since some remedial components needed to be completed before others could be started and some components were constructed in one phase while other components required multiple phases for completion. Additionally, some of the remediation will be accomplished through continued operation and maintenance of one or more systems, including modifications and enhancements to the systems. Appendix B shows the general sequence and the timing of construction for each component.

1.3.1 Interim Actions

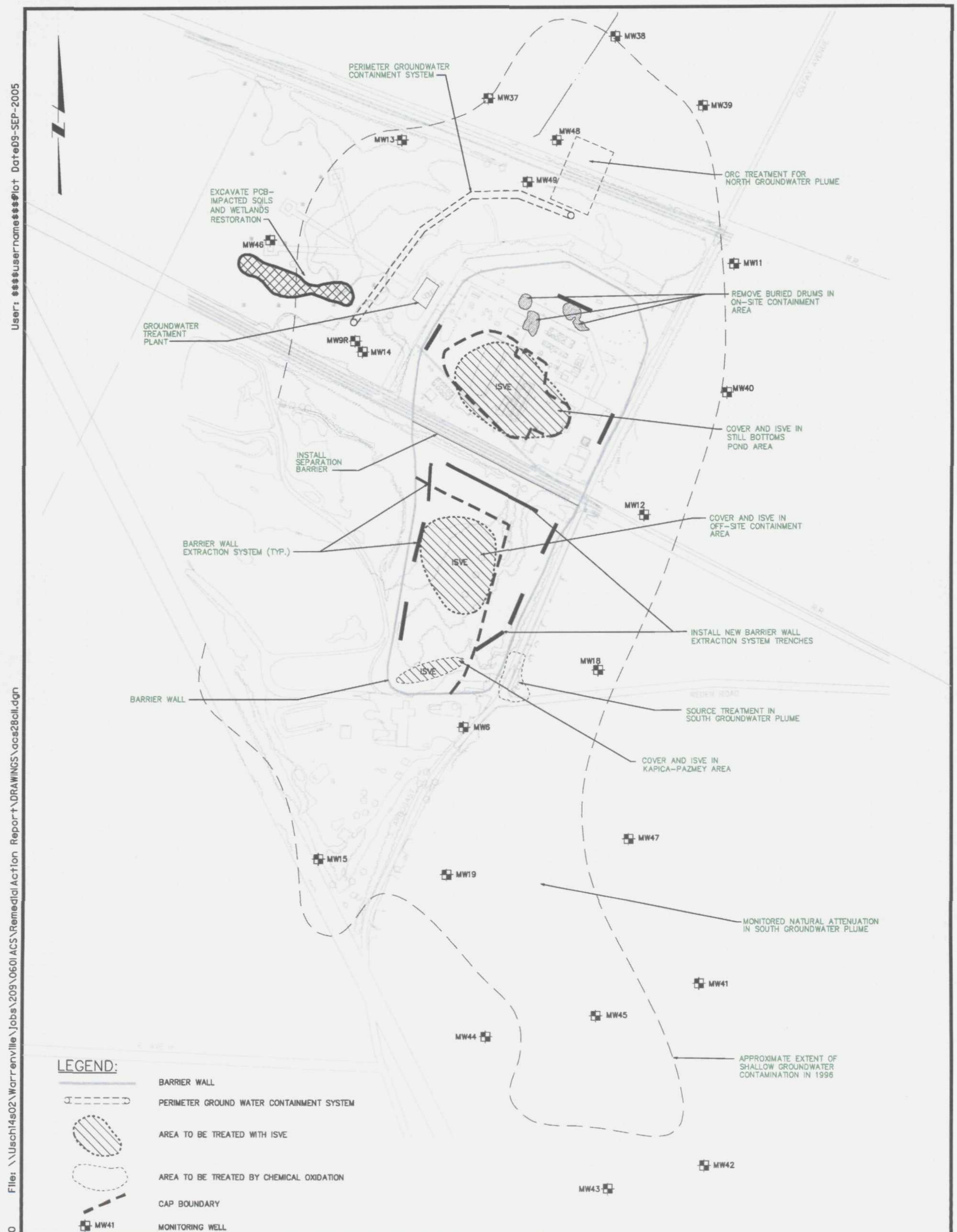
The following section describes five general components of the remedy, which were installed as part of the interim actions during 1996 and 1997.

At the completion of the RI/FS, it was evident that the remedy would be complex and so a number of Pre-Design Investigations were conducted. Recognizing that the Pre-Design Investigations and the subsequent Remedial Design would take several years to complete, the decision was made to conduct several voluntary interim remedial actions to stabilize the site. Four major interim components were constructed: the PGCS, the Barrier Wall, the Barrier Wall Extraction System and the GWTP. In addition, a one-foot clay cover was placed over the OFCA to minimize infiltration of precipitation and decrease the volume of water that would need to be treated.

Perimeter Groundwater Containment System (PGCS). The hydraulic gradients in the upper aquifer showed that groundwater flowed outward from the ACS site to the north and northwest and that there was groundwater discharge to the wetland in that area. The PGCS was constructed to form an hydraulic barrier along the north and west side of the ACS site, between the buried source material on the ACS Site and the discharge areas in the wetland.

The PGCS was constructed as a series of three trenches, each approximately 500 feet long, arrayed several hundred feet beyond the north and west ACS fence line. It was constructed in November and December 1996 and put into service at the end of January 1997, when the Groundwater Treatment Plant came on line.

Barrier Wall. A firm providing horizontal trenching technologies was subcontracted to install the PGCS, the BWES, and the Barrier Wall using a trenching machine. The trenching crew first installed the PGCS and then switched over to install the Barrier Wall. The trencher cut a vertical trench from ground surface to a depth approximately two feet into the confining clay layer at the bottom of the upper aquifer. The trencher placed both a continuous



MWH Chicago, Illinois	AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA	REMEDIAL ACTION REPORT OVERALL REMEDIAL ACTION PLAN	FIGURE 2

Barrier wall installation utilizing a trenching machine.

high-density polyethylene (HDPE) barrier and a bentonite slurry in the trench to form a barrier completely around the 30-acre ACS Site.

The clay confining layer at the bottom of the upper aquifer is located approximately 15 feet below ground surface at the north end of the site. Because the surface topography increases to the south, the depth to the clay layer also increases and is found at about 25 feet below ground surface at the south end of the site. Therefore, the depth of the Barrier Wall varies to intersect the clay layer at these different depths.

The trenching firm originally estimated that they could complete the PGCS, the Barrier Wall, and the eight extraction trenches by the end of February 1997. However, conditions were more difficult than anticipated and the Barrier Wall was not completed until July 1997.

Barrier Wall Extraction System (BWES). Completion of the 4,400-foot Barrier Wall around the ACS site formed a 30-acre "bathtub" which would need constant de-watering to prevent the overflow of groundwater. A pumping test indicated that the maximum extraction rate that could be expected from individual wells was less than one gallon per minute (gpm). Therefore, the BWES was designed and installed as a series of eight trenches near the perimeter of the contained area. Each trench was approximately 100 feet long, with a perforated pipe set horizontally along the bottom of the trench just above the clay confining layer. A vertical pipe used to extract water from the entire trench was connected into each end of the horizontal pipe.

Nine trenches were planned. However, only eight were installed during 1997. It was decided to operate those first eight trenches for several years to evaluate performance, and then add more trenches if necessary.

Groundwater Treatment Plant (GWTP). Construction of the GWTP started in the summer of 1996 and was completed in February 1997. The plant was started up on February 27, 1997 and has been operational since then. The initial influent water came from the PGCS located outside the barrier wall and therefore it was relatively low in contaminants compared to the levels expected when the water came from inside the barrier wall. The primary treatment technology for the organic compounds was an Ultra-violet Oxidation Unit. The building and water treatment train were designed to be modular and scalable since it was known that water quality would change over time and with operation.

Temporary Cover, Off-Site Area. Although ACS used the OFCA as landfill for waste disposal, they had used the native silty sand soil for final cover on the landfill when they closed it in the mid-1970's. It was recognized that infiltration (and therefore water requiring treatment) could be minimized by reducing the permeability of the cover soil in the OFCA. Therefore, during the winter of 1997 and 1998, a temporary one-foot clay layer was installed across most of the 15-acre OFCA.

Enhancement to the PGCS, Barrier Wall and the BWES.

GWTP Upgrade. When the BWES came on-line and started de-watering the area inside the barrier wall, the organic loading of the water piped to the GWTP increased. A treatability study indicated that the GWTP would be more efficient if the treatment train were expanded to include a biological unit and an air stripper. So in 1999, the GWTP building was expanded, and these units were added. (Operational testing revealed that the stripper was insufficient to meet the demands of the water stream. The stripper unit was later replaced by the aeration tank.) The GWTP upgrade was completed in December 2000.

Separation Barrier Wall. The one-foot temporary clay cover that had been placed over the OFCA in 1999 was effective in limiting the infiltration of precipitation over the southern half of the site. It was recognized that overall de-watering inside the Barrier Wall could be better controlled if the site could be divided into two parts. Therefore, beginning in January 2001, a 700-foot slurry wall was constructed east to west at the north end of the OFCA, thereby separating the active On-Site Area from the OFCA. The Separation Barrier Wall was keyed two feet into the clay layer underlying the upper aquifer.

Enhancement of the BWES. Several additions were made to the BWES to enhance its efficiency after the Separation Barrier Wall was completed. Extraction capacity in the OFCA was increased by adding two extraction trenches south of the Separation Barrier Wall. Extraction Trench 10 and 11 were completed in February and March 2001.

Completion of the Separation Barrier Wall decreased the extraction capacity for the On-Site Area, located north of the separation wall. Therefore, during the design phase for the SBPA (on-site) In-Situ Soil Vapor Extraction (ISVE) system, the ISVE system was modified to include 21 dual-phase extraction wells that could extract both organic vapors and groundwater (or other liquids). These dual-phase wells were installed with the SBPA ISVE system in October 2002.

1.3.2 Source Removal

The Final Remedy for the ACS Site protects human health and the environment using a combination of removal, treatment, and containment. Several activities were conducted to remove waste and contaminants from documented source areas.

A combination of investigative techniques from soil borings and test pits to geophysical survey indicated that drums were buried at several locations on the ACS Site. Locations were refined by test pit excavation in February 2001. In April and May 2001, a drum removal was conducted. A total of 249 intact drums and 1,449 non-intact drums were removed from two areas in the On-Site Area. The intact drums were over-packed, sampled for characterization and then sent off-site for incineration. The non-intact drum material was cut into smaller pieces, loaded into roll-off boxes, and also sent to the off-site incinerator.

PCB-containing sediments were removed from the wetland located to the west of the ACS Site during August and September 2001. After approximately 18 inches of impacted sediments were removed, the 1.5-acre cleanup area was over-excavated to depths of approximately 10 feet to create a pond.

1.3.3 ISVE and Sparge Systems

The main objective of the ACS ISVE system is to extract mobile organic compounds. The mobile compounds are primarily VOCs but also include some semi-volatile compounds. The ISVE system works together with the BWES, which lowers the water table to expose the buried waste. The system also includes sparge points to treat several zones where VOCs were identified at depths below the practical limit to de-water.

Review of the Site history combined with the results of subsurface investigations, showed that the char-

MWH engineer using a Global Positioning System to locate the extent of the excavation of PCB-containing sediments in the wetlands west of the ACS site.

Crane lowering the blower shed for the Off-Site Area ISVE system onto the concrete pad that contains the vapor conveyance piping.

acteristics of the waste buried on the ACS Site are highly variable. It was determined that a pilot study would be of limited use, since a single pilot study would represent only a limited area. Therefore, the ACS ISVE system was designed as a modular system and implemented in two major phases with three sub-phases. Following this approach, the ISVE system was constructed to respond to the specific conditions across the Site.

First, the ISVE system was installed in the OFCA and K-P Area and operated in lieu of a pilot study. The results from the first six months of operation were used as the basis for activating the full-sized extraction and treatment system. After one year of operation, the system performance was evaluated and then enhancements were designed and implemented to maximize extraction and treatment capacity and efficiency.

After the OFCA system had been operating for eighteen months, the SBPA ISVE system was similarly implemented with the initial system, followed by evaluation, and then enhancement, to the final system.

The ACS ISVE System is now operating in the fifth of eight planned phases.

1) 0 to 6 months: Operation of the initial 1,000 cubic feet per minute (cfm) ISVE system at the OFCA/K-P Area,

2) 6 to 12 months: Evaluation of the system, and design of modifications to optimize operations of the full-size ISVE system to address the entire OFCA/K-P Area,

3) 12 to 18 months: Installation of additional 1,000 cfm blower, to double extraction capacity of OFCA/K-P Area ISVE system,

4) 18 to 24 months: Operation of the initial 1,000 cfm ISVE system at the SBPA,

5) 24 to 30 months: Evaluation of the SBPA system and design of modifications to optimize operations of the full-size ISVE system to address the entire SBPA (also continuing to operate the full-size OFCA/K-P Area system),

6) 30-month to full size: Reconfiguration of the SBPA in accordance with approved system enhancements, including modifying several ISVE wells to air injection wells, and modifying several vapor extraction wells to free-phase removal wells,

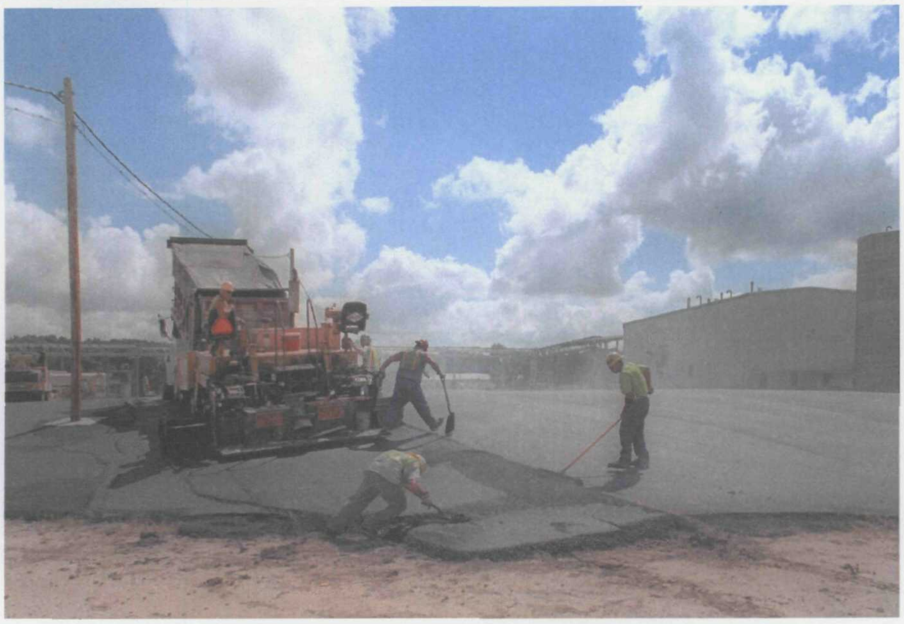
7) Active Operation: Continuous Active Operation of OFCA/K-P Area System and SBPA System with monitoring and maintenance. System performance is being monitored and evaluated. Recommendations are made regarding increasing effectiveness and efficiency, and

8) Cycle Operation: Operation of the ISVE systems in on/off cycles, once mass removal becomes limited by constituent diffusion rates.

The cycle operation will be continued for both On-Site and Off-Site Systems until the VOC removal rate drops to 100 pounds per day (lb/day) or less for the combined systems in active mode. At that point, the ISVE system will be transitioned to a passive system by discontinuing use of the blower system. The seals at the top of each well will be removed, leaving the ISVE wells open to the atmosphere. However, the BWES will continue to operate inside the Barrier Wall, removing groundwater and any mobile compounds entrained in that groundwater.

1.3.4 Capping and Covering

Various parts of the ACS Site have been covered at different times over the past seven years. A temporary one-foot clay cover was placed on most of the Off-Site Area following the completion of the Separation Barrier Wall (2001). The permanent cover was placed over the OFCA and K-P Area after construction was completed on the OFCA/K-P Area ISVE system. The cover included an engineered portion over the areas containing buried waste, and a simple clay and soil cover over the rest of the area that was inside the barrier wall. The engineered cap consisted of a clay layer, covered with a flexible membrane liner (FML) layer and final soil cover and vegetation. The FML was placed over approximately six



Construction of the asphalt cover over the SBPA.

acres during August and September 2002.

A temporary cover was placed over the SBPA after installation of the ISVE, sparge and dual-phase extraction wells. The final asphalt cap was installed in September 2004. Additional covering of the ACS facility could be considered in the future if there is a cost benefit to be realized from further reducing the infiltration of precipitation across the ACS plant. A specific cost benefit analysis has not been conducted at this point.

1.3.5 Groundwater Remediation

The contaminant of concern identified for the ACS Site is benzene. Two areas of groundwater contamination were identified in the upper aquifer and one area was identified in the lower aquifer.

Groundwater pump and treat was the primary treatment technology designated to remediate groundwater in the original 1992 ROD. The PGCS, a pump and treat system, was installed in 1996 as a component of the interim remedial measures. (The Barrier Wall was another interim remedial measure that isolated the buried waste, the source of the groundwater contamination). Pre-design activities and treatability studies were conducted following construction of the interim measures to assess the applicability of new and additional technologies for remediating the groundwater. In September 2004, the U.S EPA issued an ESD, which made some changes to enhance remediation of the impacted groundwater. The three components of the revised groundwater remediation program are pump and treat, in-situ chemical oxidation (ISCO), and MNA.

1.3.6 Upper Aquifer North Area Remediation

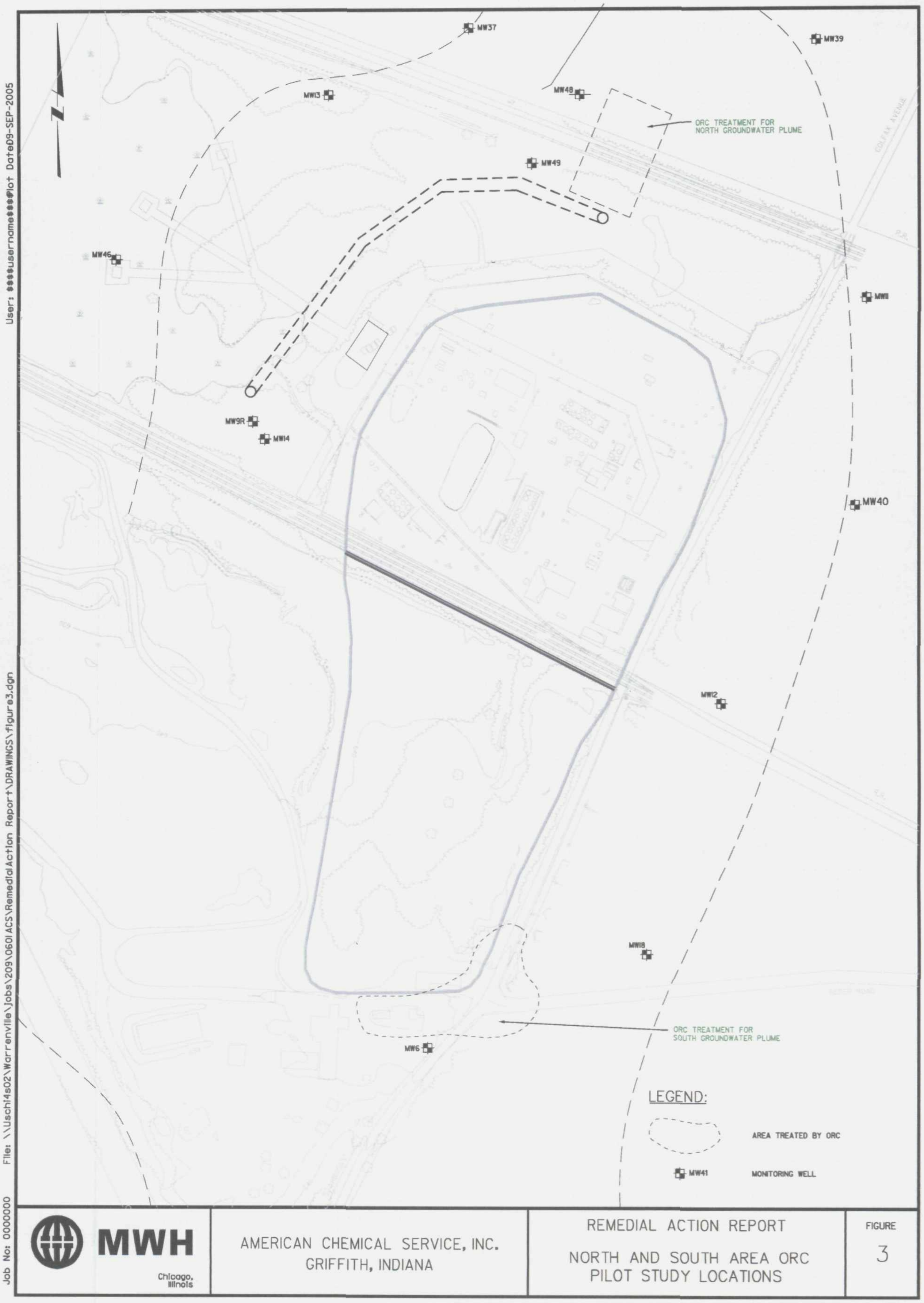
The PGCS, installed in 1996, is a pump and treat system that provides a hydraulic barrier to groundwater migration away from the site in the upper aquifer and also collects contaminated upper aquifer groundwater between the barrier wall and the wetland. The PGCS has been operating since February 1997, prohibiting further off-site migration of contaminants.

A pilot study was conducted in the north area in 1999 to evaluate the potential for oxygen release compounds (ORC) to treat the north area groundwater by in-situ oxidation technology. Groundwater monitoring has shown that concentrations of the contaminant of concern have decreased by more than an order of magnitude since the Barrier Wall and the PGCS were completed. No further in-situ treatment is deemed necessary, and the north area will continue to be remediated by pump and treat (the PGCS) and MNA.

1.3.7 Upper Aquifer South Area Remediation

A pilot study to evaluate ORC was also conducted in the south area during 2001. Figure 3 (page 10) illustrates the locations of both the North and South ORC Pilot Studies in relation to the ACS plant. While ORC in the south area was able to dramatically reduce the benzene concentrations in the groundwater immediately after the application, it was found that the benzene concentrations in groundwater rebounded after approximately six months. Subsequent investigations showed that there were residual organic compounds including benzene trapped in the smear zone above the water table in the south area, extending approximately 200 feet out from the barrier wall.

Pumping and treating was not a viable remedial technology to remove the smear zone material, since extracting groundwater would lower the water table, leaving the residual hydrocarbons above the water table.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MW37
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MW48
ORC TREATMENT FOR NORTH GROUNDWATER PLUME
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MW46
P.R.
MW9R
MW14
MW40
MW12
MW18
ORC TREATMENT FOR SOUTH GROUNDWATER PLUME
MW6
LEGEND:
AREA TREATED BY ORC
MW41
MONITORING WELL
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AMERICAN CHEMICAL SERVICE, INC.
GRIFFITH, INDIANA
REMEDIAL ACTION REPORT
NORTH AND SOUTH AREA ORC PILOT STUDY LOCATIONS
FIGURE
3

Therefore, a pilot study was conducted to test the effectiveness of a more aggressive in-situ oxidation technology. A pilot study conducted in April 2004, using Fenton's reagent showed that the technology could be effective.

A full-scale in-situ remedial program was developed from the pilot study results. The first full-scale application was completed in September 2004. Second and third full-scale applications were made in April and August 2005. Post-application sampling to evaluate the effectiveness followed each full-scale application.

The full-scale chemical oxidation injections resulted in significant decreases in benzene and hydrocarbon concentrations. Post-application sampling for the third injection will be completed in October 2005. The results may indicate that the south area has been transitioned to an MNA remedy, or they may show that it will be necessary to focus some additional Fenton's reagent injections before the area can fully transition to MNA.

1.3.8 Lower Aquifer Remediation

The results from the lower aquifer investigation will be used to assemble the hydraulic control system to inhibit further off-site migration of benzene in the lower aquifer. The previously existing monitoring wells, the new temporary monitoring wells, and the piping installed for the pumping test will all be available as potential components of a cost-effective extraction system that will be designed to achieve hydraulic control over the affected area. Monitoring will continue to document that the benzene contamination has been captured and that it is no longer migrating off site in the lower aquifer.

1.4 SITE STATUS

At the time of this report, the implementation of the final remedy for the Site as defined by the Consent Decree has been completed. The systems that were installed have transitioned to an Operation and Maintenance phase.

American Chemical Service, Inc. continues its operations with a full complement of employees serving the community as it has throughout the construction phase.

Aerial photograph of the ACS Site, viewed from the Northeast in 2003.

2.0 PERFORMANCE STANDARDS

Comprehensive monitoring activities are conducted at the ACS Site to verify compliance with performance standards established in the Statement of Work (SOW) for the Remedial Design and Remedial Action at the Site. The performance requirements for each remedial system to achieve its design objectives are discussed:

2.1 ISVE SYSTEMS

The main objective of ISVE at the ACS Site is to reduce the mass of VOCs in source areas by extracting mobile VOCs from below the ground surface. Two ISVE systems were designed and constructed to treat the three source areas: the SBPA, OFCA, and K-P Area. The extracted vapor from these systems is conveyed to two thermal oxidizers, located in the Groundwater Treatment Plant, prior to atmospheric release. Operation of the ISVE systems will continue in the Off-Site Area and SBPA until the total removal rate has been reduced to the remedial goal of 100 lb/day or less for the combined systems.

2.2 DEWATERING/ CONTAINMENT

A groundwater extraction system inside the Barrier Wall was installed to maintain hydraulic capture within the wall. The system is referred to as the BWES. The current system is comprised of eight 100-foot long extraction trenches, one 150-foot long extraction trench, and one 350-foot long extraction trench. Locations of the extraction trenches are shown on Figure 10 (page 29). Also aiding in the dewatering efforts within the Barrier Wall are Dual Phase Extraction (DPE) wells that exist in 21 of the 46 ISVE wells located in the SBPA. The DPE well locations are identified on Figure 7 (page 22).

The purpose of the extraction trenches and dual-phase extraction wells is to dewater the upper aquifer in the vicinity of the ISVE systems in the SBPA, the OFCA, and the K-P Area. Lowering the water table exposes the majority of the soil contamination to the vacuum imposed by the ISVE blowers and creates an air flow through the soil and waste. Once the zone of contamination is exposed, the ISVE system will withdraw contaminated vapors from the subsurface for treatment. Exposing the soil will increase the effectiveness of ISVE systems by exposing the areas with the largest volumes of contaminants. In the Off-Site Area, the objective of the BWES is to lower the water table from preexisting levels to 626 feet above mean sea level (amsl). The target water elevation in the On-Site Area is 629 feet amsl.

The engineered covers in both the SBPA and Off-Site Area were designed and constructed to accomplish the following objectives:

1) Eliminate potential direct contact with VOC- and PCB-contaminated soils (and lead-contaminated soils in the K-P Area),
2) Eliminate potential worker contact with VOC-contaminated groundwater,
3) Reduce the potential for contaminant migration to groundwater by reducing infiltration into these areas, and
4) Provide a surface seal for the ISVE system to minimize potential short-circuiting and maximize the capture of VOC vapors.

Construction of the separation barrier wall utilizing a trenching machine.

The design objectives for the engineered covers have been met by a combination of monitoring and verification both during construction and after construction. The field engineer monitored the construction and verified that the engineered cover was constructed in accordance with the Final Design. Those activities are reported in the Off-Site Area Final Engineered Cover Construction Completion Report (MWH, June 2004), and the Still Bottoms Pond Area Final Engineered Cover Construction Completion Report (MWH, January 2005). The CCRs also provide the as-built drawings and describe any variances from the final design. The following monitoring and verification activities are continuing as part of the ongoing O&M defined for the ACS Remedial Systems:

- Monitoring of vacuum level and air flow through the ISVE system to ensure integrity of the engineered cover,
- Monitoring water levels in wells and piezometers within the boundaries of the cover, and documenting the integrity of the engineered covers.
- Quarterly inspections and inspections after storm events to discover cracking or erosion of the engineered covers and then repair them.

2.3 GROUNDWATER TREATMENT PLANT

Construction of the original GWTP was completed in 1997. Significant upgrades (detailed in Section 4.4.2) were completed in December 2000 to meet the expected groundwater extraction quantity and, with the anticipated increase in both volume and contaminant loading, enhanced quality treatment as required to implement the Final Remedy. The treatment system of the GWTP contains the components necessary to provide for flow equalization, free-phase product removal, emulsified product removal, organics removal and destruction, metals removal, solids removal, solids handling, disinfection, and air emission control.

The groundwater treatment system was designed and constructed to reduce the concentrations of contaminants that pass through the GWTP processes to acceptable levels prior to discharge to the wetlands or the atmosphere. The acceptable levels are the effluent quality standards established by IDEM and U.S. EPA as shown in Table 1 and the off-gas air quality standards discussed in section 7.2.3 of this report.

2.4 CHEMICAL OXIDATION

The goal of the chemical oxidation remediation is to reduce the volume of residual hydrocarbon material present in the water table smear zone, minimizing it as a source of ongoing groundwater impact in the south area. Upon completion of the full-scale chemical oxidation applications, the upper aquifer will be transitioned to a MNA program.

3.0 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Guidelines for the quality assurance/quality control (QA/QC) procedures used throughout the RA are outlined in a series of Site Management Plans submitted by MWH and approved by the U.S. EPA. The program enabled the U.S. EPA to determine that all analytical results reported were accurate and adequate to ensure satisfactory execution of the remedial action in a manner consistent with the requirements of the ROD. The procedures outlined in the plans also ensured that the work would be performed in a manner protective of human health and safety. The site-specific management plans are outlined below:

1) The *Construction Quality Assurance Plan* (CQAP) (Montgomery Watson, June 1999) addresses quality assurance activities that are conducted to document remedial design conformance during the RA installation and construction at the Site. These activities include inspection, sampling and testing, corrective action, and documentation.

2) The *Quality Assurance Protection Plan* (QAPP) (MWH, November 2001) presents the project organization, objectives, functional activities, and project-specific QA/QC procedures for RD/RA activities at the ACS Site.

3) The *Performance Standard Verification Plan* (PSVP) (Montgomery Watson, June 1999) addresses monitoring activities that will be conducted to verify compliance with performance standards established in the Statement of Work for RD/RA at the Site.

4) The *Field Sampling Plan* (FSP) (Montgomery Watson, April 1999) presents the details of the RA field sampling activities and provides field sampling procedures and protocols. The FSP also addresses the sample documentation, tracking, and handling.

5) The *Site Safety Plan* (SSP) (Montgomery Watson, June 1999) establishes health and safety procedures for field activities that will minimize potential risk to MWH personnel performing on-site work.

6) The *Health and Safety Field Manual* (MWH, June 2005) provides the most up-to-date health and safety considerations and procedures that must be followed as Site activities transition from the construction phase to long-term operations and maintenance.

4.0 FINAL REMEDIAL ACTION CONSTRUCTION

Construction Completion Reports (CCRs) were issued following completion of the major components of the RA, providing specific details about the construction activities for each component. The following section summarizes the construction activities and CCRs for each remedial action conducted at the ACS Site, divided by Consent Decree category.

4.1 SITE PREPARATION AND CLEANUP

4.1.1 Fire Pond Closure

The Fire Pond was located in the center of the ACS facility. Since 1975, it had been a reservoir, available to provide water needed for firefighting on the ACS Chemical Plant. The location of the pond is shown in Figure 1 (page 2).

The Fire Pond was filled during 2001 with soil excavated during site remediation. In the spring of 2001, approximately 2,500 cubic yards of visually impacted soils and debris from the drum removal activities (described in section 4.1.3) were placed in the Fire Pond (Final Buried Drum Removal in On-Site Containment Area Construction Completion Report [MWH, March 2003]). Also, during the PCB-impacted soil excavation activities in the fall of 2001, approximately 4,900 cubic yards of impacted material were excavated from the wetland west of the ACS facility and used to fill and close the Fire Pond.

The volume of PCB-impacted soil and visually impacted soil and debris placed in the Fire Pond resulted in higher ground surface elevations than originally anticipated for the SBPA cover. In order to meet the design elevations, approximately 3,800 cubic yards of material were removed from the Fire Pond and moved to the Off-Site Area in July 2002 to fill and shape a drainage swale in the cover area. Further details of these activities are included in the Construction Completion Report for the Final Engineered Cover in the Off-Site Area (MWH, June 2004). The soil left in the Fire Pond was incorporated as part of the SBPA engineered cover. The inclusion of the Fire Pond in the engineered cover for the SBPA constituted the final closure of the Fire Pond.

Further information on the Fire Pond closure can be found in the *Still Bottoms Pond Area Interim Engineered Cover Construction Completion Report, including Fire Pond Closure* (MWH, March 2004).

The original site "fire pond" had been virtually drained as the groundwater level lowered inside the barrier wall.

4.1.2 Pile Consolidation

During 1996 and 1997, MWH constructed a barrier wall around the On-Site and Off-Site Areas to contain buried source material. MWH also constructed the PGCS to capture impacted groundwater before it migrated off-site. Excavation for these two construction activities generated excess soil spoils. MWH developed a Spoils Management Plan that was included in a November 6, 1996 letter to the U.S. EPA entitled "Management and Temporary Storage of Construction Derived Soils." The plan was developed to manage the spoils generated or (expected to be generated) during construction activities. In accordance with the plan, the material was segregated into the five piles located in the Off-Site Area. The main objectives of the Off-Site Area spoils piles consolidation were to:

1) Eliminate potential direct contact with contamination within the

spoils piles by consolidating them beneath the engineered cover; and

2) Utilize the consolidated material as fill material beneath the engineered cover to promote proper surface water drainage from the engineered cover.

Additional waste consolidation activities included shearing and placement of approximately 600 drums whose contents were generated during previous investigation and construction activities.

The Final Remedial Design Report called for the management and containment of the spoils piles in the Off-Site Area. During May 2001, the spoils were consolidated for containment beneath the cover. The following is a list of the spoils piles that were developed under the plan, with a description of how they were consolidated, graded, and managed.

1) **Upper Aquifer Debris Pile**: The upper aquifer debris pile consisted of assorted landfill debris collected from the upper aquifer region of soil during the 1997 installation of the Perimeter Barrier Wall (described in Section 4.3.1).

2) **Upper Aquifer VOC Soil Pile**: The upper aquifer VOC soil pile consisted of soil with VOC concentrations below 500 parts per million (ppm) collected from the upper aquifer region during the 1997 installation of the Perimeter Barrier Wall.

3) **The K-P Spoils Pile**: The K-P spoils pile debris was sheared into manageable pieces. The sheared debris was relocated to a low area on the north side of the Off-Site Area that required additional fill to reach final grades. This area was located between the upper aquifer debris pile and the upper aquifer VOC soil pile.

4) **The VOC and PCB Soil Pile**: The VOC and PCB soil pile was re-graded from May 29, 2001 to May 31, 2001.

5) **The PCB Soil Pile**: The PCB soil pile was also re-graded from May 29, 2001 to May 31, 2001.

Figure 4 (page 17) shows locations of these spoils piles and investigation derived wastes (IDW) after consolidation and re-grading activities, prior to the installation of the interim engineered cover.

Compaction of the spoils piles was completed on June 12, 2001 and a temporary clay cover was installed to minimize worker exposure to the newly consolidated piles. Further discussion of the design of the consolidated spoils pile is available in the *Final Off-Site Area Interim Engineered Cover Construction Completion Report including Spoils Pile Consolidation* (MWH, February 2003).

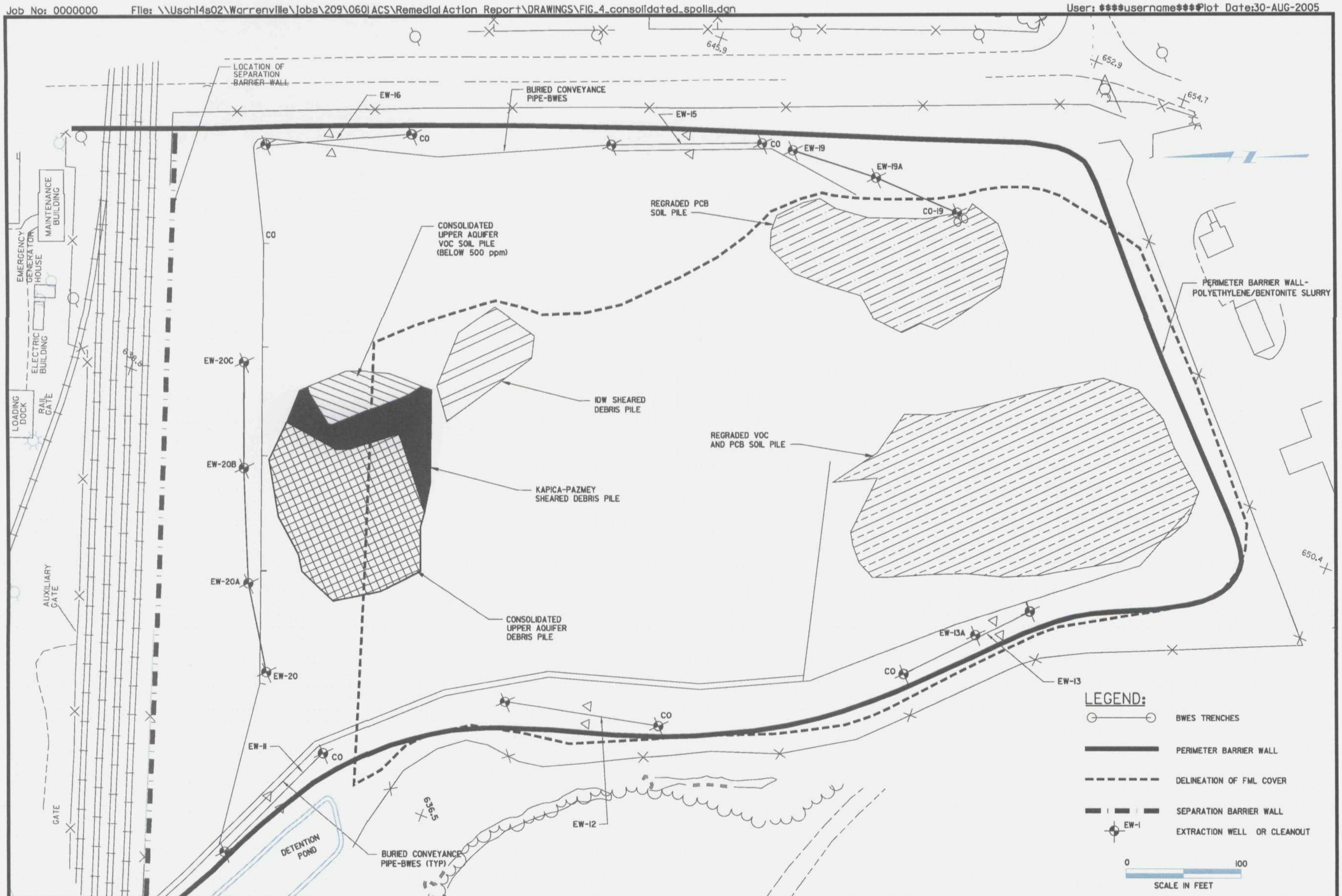
4.1.3 Drum Removal

MWH acquired information about the condition and placement of buried drums in the ONCA during various investigation and construction activities. Buried drums were identified in the On-Site Containment Area during the RI. Also, during the installation of a waterline to the GWTP in early 1997, 41 drums were discovered in the ONCA and subsequently removed. These drums were placed into over-pack drums and temporarily placed in a secure area of the Off-Site Area. Buried drums were also encountered in 1997 during a separate excavation for the Barrier Wall installation along the northern end of the facility.

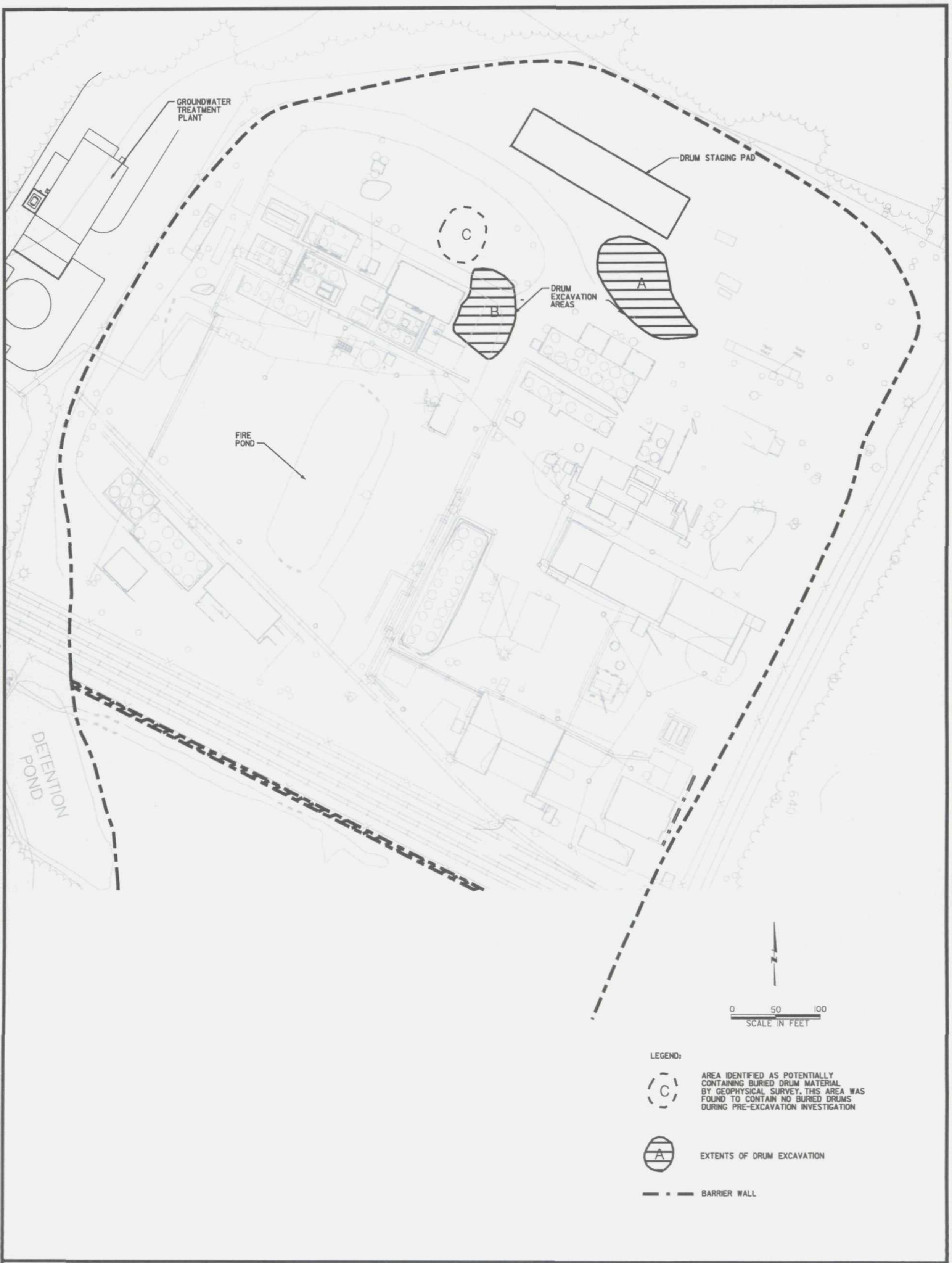
A geophysical survey was conducted on February 23 and 24, 1998 to delineate the extent of buried drums in the On-Site Area. Both a magnetometer and ground penetrating radar were used. The geophysical surveys showed three areas of geophysical anomaly and the results were used to estimate that there were between 1,000 and 2,500 drums buried in three areas of the ONCA, designated as Area A, Area B, and Area C. In February 2001, a series of test pits were conducted across the three anomaly areas. Buried drums were found in Areas A and B, but no drums were found in Area C. The drum containing areas are delineated on Figure 5 (page 18).

The drum excavation began on April 27, 2001 and was completed on May 24, 2001. The removal process consisted of the excavation, characterization, and disposal of buried drums and drum debris from the ONCA. A total of 1,698 drums were removed from the delineated areas, 249 of which were placed in 85-gallon over pack drums. These were subsequently sampled and analyzed on Site according to the procedures outlined in the Work Plan. The remaining 1,449 drums were non-intact, and therefore placed into roll-off boxes for later sampling and disposal. In addition, 2,496 cubic yards of visually impacted soil from the excavation were placed in the Fire Pond. The Fire Pond is now being actively treated by the SBPA ISVE system.

The over-packed drums and roll-off boxes were stored on Site as disposal options were evaluated. Upon



MWH Chicago, Illinois	AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA	REMEDIAL ACTION REPORT SPOILS PILES LOCATION IN OFF-SITE AREA AFTER CONSOLIDATION AND REGRADING	FIGURE 4



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MWH Chicago, Illinois	AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA	REMEDIAL ACTION REPORT DRUM REMOVAL AREAS	FIGURE 5

Intact drums in Area A being placed in over-pack containers. After all the drums had been removed the excavation was dewatered, filled with clean soil, and then compacted.

approval of the disposal facility by U.S.EPA and IDEM, the over-packed drums were shipped off-site for incineration. Then the contents of the roll-off boxes were cut into manageable-sized pieces, re-consolidated into the roll-off boxes and shipped off-site for incineration. The total volume of material sent to the Onyx Incinerator in Port Arthur Texas was 234 over-packed drums and 380 cubic yards of drum debris contained in roll-off boxes. The drum removal and disposal activities were conducted in accordance with the Agency-approved Work Plan entitled *Buried Drum Removal Plan*, (Montgomery Watson, January 1999).

Further discussion regarding the drum removal activities in the On-Site Area is provided in the *Final Buried Drum Removal in On-Site Containment Area Construction Completion Report*. (MWH, March 2003).

4.1.4 Wetlands PCB Excavation and Restoration

A two-phased wetland investigation performed by MWH in 1996 showed that the surface sediment in a one-and-a-half acre area in the wetland, to the west of the active ACS plant, contained PCBs above 1 ppm. The final remedy included removal of these sediments in order to prevent ingestion and dermal contact with the contaminated material.

Removal of the PCB-impacted soil from the wetland area in the west portion of the Site was conducted during August and September 2001. The work was performed in accordance with the U.S. EPA and IDEM-approved *PCB-Impacted Soil Excavation Work Plan* (Montgomery Watson, April 1999) and the *Final Remedial Design Report* (Montgomery Watson, August 1999).

Approximately 4,900 in-place cubic yards of PCB-impacted material were removed from the wetland according to the post-excavation survey data. Materials excavated from the PCB-impacted areas were staged in the Fire Pond area and characterized through laboratory analysis. Characterization data indicated that the excavated material contained PCB concentrations less than 50 milligrams per kilogram (mg/kg), the concentration at which the Work Plan called for off-site disposal at a Toxic Substances Control Act (TSCA)-approved facility. Therefore, this material was placed in the Fire Pond and compacted in accordance with the U.S. EPA approved remedial design. This constituted part of the Fire Pond Closure task (described in Section 4.1.1).

PCB-impacted sediment being removed from the wetland area in August 2001.

Completed open-water restoration in November 2001.

The restoration of the wetland by the construction of an open-water pond began on September 4, 2001 and was completed on September 24, 2001. Figure 6 (page 21) shows the final extent of the wetland pond. MWH estimates that approximately 6,600 cubic yards of soil were removed from the wetland during pond construction in addition to the 4,900 cubic yards of soil removed during the excavation of PCB-impacted material. The pond construction material was stockpiled for use in the construction of the Off-Site Area engineered cover.

Material removed during the pond construction was used to backfill the eastern portion of the excavation area to original grade. The area was further shaped to improve drainage and allow volunteer prairie grasses and plants to re-populate the area. Further information about the PCB-impacted soil excavation and wetland restoration can be found in the *Final PCB-impacted Soil Excavation In the Wetland Area Construction Completion Report* (MWH, November 2002).

4.2 IN-SITU SOIL VAPOR EXTRACTION

In-situ soil vapor extraction was identified in the modified ROD as the appropriate technology to address the principle threat of the Site by reducing the risk of exposure to contaminated vapors and reducing the potential migration of mobile contaminants to the groundwater. ISVE systems were constructed in both the Off-Site Area and the SBPA. As of September 1, 2005 both the Off-Site and SBPA ISVE systems have together removed an estimated 600,000 lbs of VOCs from the ground.

4.2.1 Off-Site ISVE System

The ISVE wells for the Off-Site ISVE system were installed between August 27 and September 20, 2001. A total of 42 ISVE wells and three air sparge (AS) points were installed in the Off-Site Area. Twelve ISVE wells (SVE-1 through SVE-12) were installed in the K-P Area and thirty ISVE wells (SVE-13 through SVE-42) were installed in the OFCA. The air sparge points were designated as AS-7 through AS-9. Figure 7 (page 22) displays the ISVE well locations of the Off-Site ISVE system. A blower shed was installed in the Off-Site Area to house the vacuum blower system and condensate removal system. Conveyance piping was installed to connect each ISVE well and air sparge point to the piping manifold in the blower shed. Extracted vapor and collected condensate are delivered to the GWTP for treatment via piping installed between the blower shed and GWTP.

Controls and instrumentation were installed to integrate the ISVE system with the operation of the GWTP. Installation of the underground piping began on November 28, 2001 and was completed in July 2002. First, the interim clay cover was excavated along the pathways to contain the piping. Then after the piping was installed, the excavated clay was backfilled over the piping and compacted.

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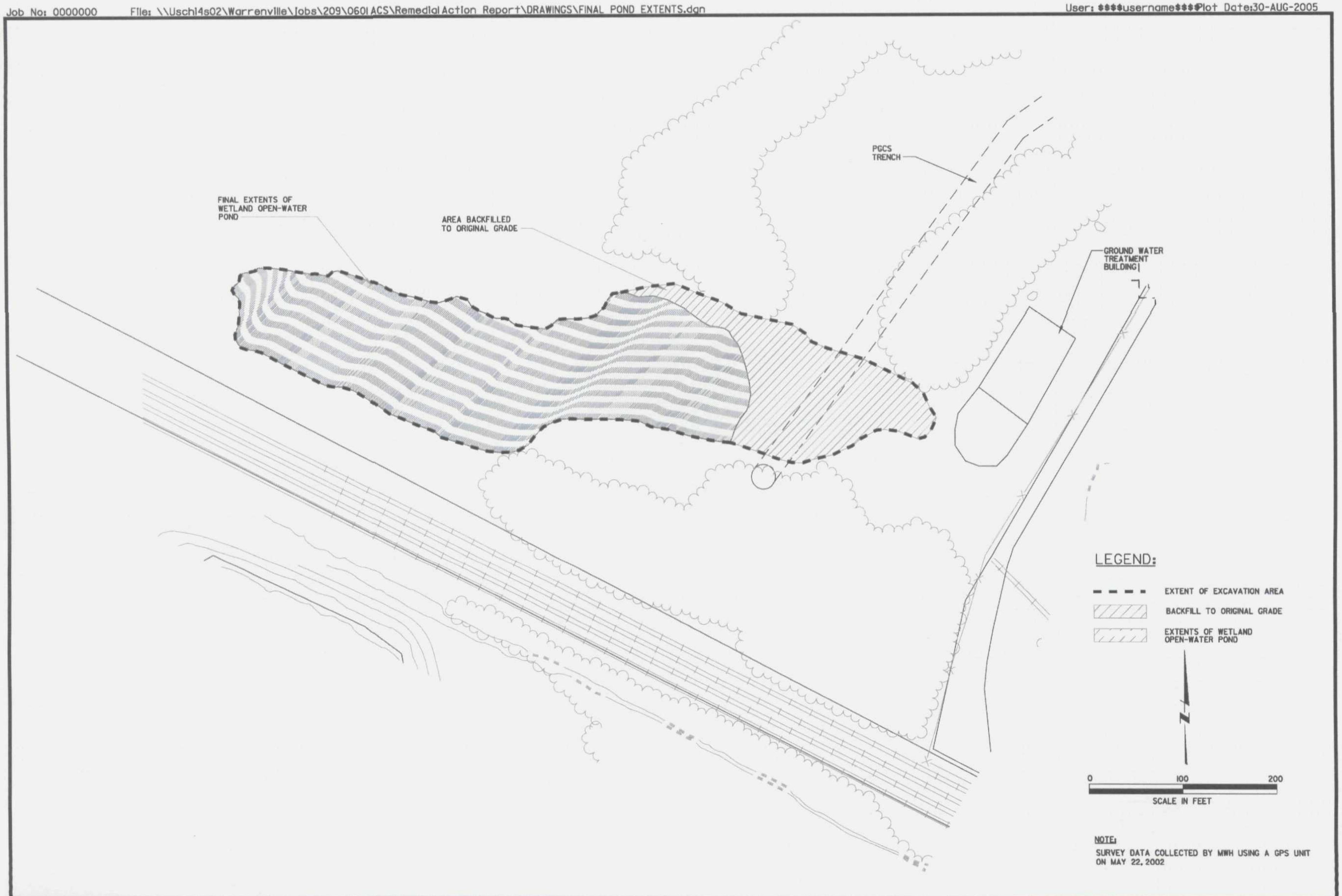

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REMEDIAL ACTION REPORT
FINAL EXTENT OF WETLAND OPEN-WATER POND

FIGURE 6

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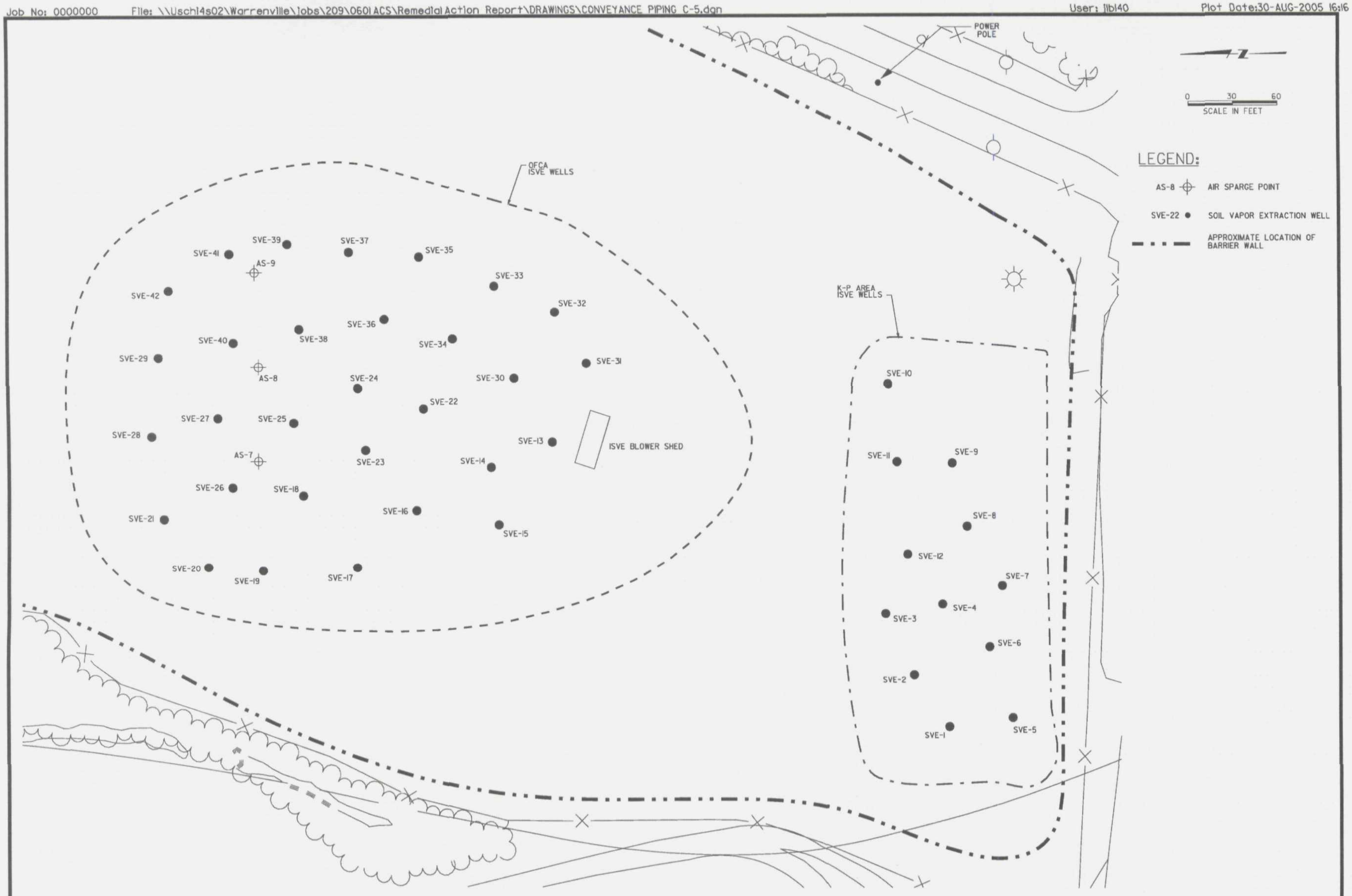

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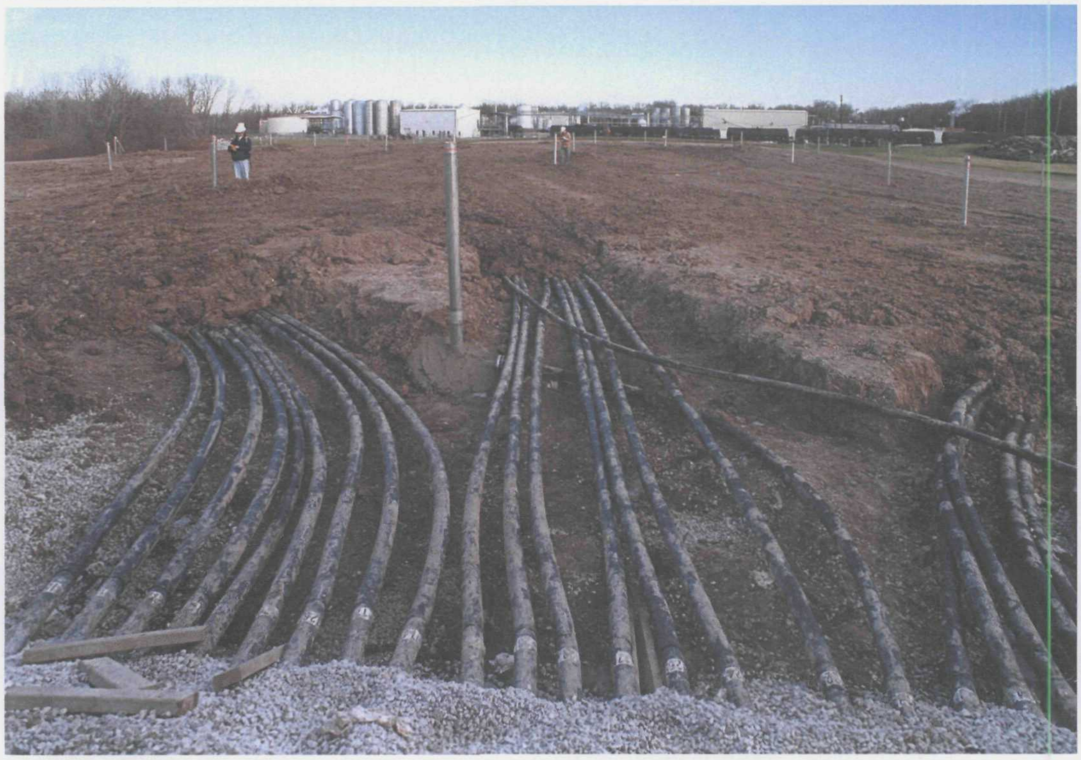
REMEDIAL ACTION REPORT

OFF-SITE ISVE SYSTEM

FIGURE 7



The completed ISVE piping for wells north of the blower shed. At the time of this photograph, the ISVE well and piping in the foreground have yet to be backfilled. A bentonite plug is visible at the base of the nearest well in the center of the photo. The plug provides an additional seal for the connection between well and piping. The smaller diameter pipe crossing over the others is piping associated with one of three air sparge points.

To treat the high concentrations of contaminants in the vapor stream anticipated during the initial operation of the ISVE system, a recuperative thermal oxidizer and scrubber system was installed at the GWTP. The thermal oxidizer and scrubber units were delivered to the site on February 7, 2002. Start-up of the unit occurred on February 17, 2002. A technician was on-site from February 17 to March 14, 2002 to supervise the installation, check out, inspect, prepare the system for process gas flow, and perform the initial startup. Normal system operations began on April 1, 2002.

Further discussion regarding the design of the Off-Site ISVE system is available in the *Off-Site Containment Area and Kapica-Pazmey Area In-Situ Soil Vapor Extraction Systems Construction Completion Report* (MWH, March 2004).

4.2.2 SBPA ISVE SYSTEM

The SBPA ISVE system was installed to meet the same objectives as the Off-Site ISVE system, that is, reducing the mobile VOCs in the source areas by means of vapor extraction. To aid in the dewatering efforts within the Barrier Wall, a portion of the ISVE wells were installed as DPE wells. The DPE wells were designed and constructed to extract both vapor and groundwater from the SBPA.

A DPE well being installed in the SBPA ISVE system.

A total of 46 wells were installed for the SBPA ISVE system between October 24 and November 15, 2002. Twenty-five were ISVE wells and twenty-one were DPE wells. In addition, six air sparge points were installed in the SBPA. Figure 8 (page 24) depicts the locations of the wells and sparge points.

Extracted vapor and collected condensate are delivered to the GWTP for treatment via piping installed between blower shed and the GWTP. This piping was installed previously as part of the construction of the Perimeter Barrier Wall. The ISVE system required installation of controls and instrumentation and integration of the ISVE system operation with the operation of the GWTP.

The groundwater conveyance piping was installed between September 30 and October 10, 2002. The vapor conveyance pipes and the air supply piping were installed between November 21, 2002 and April 24, 2003. The piping was installed above the clay and geotextile layers of the cover. This modification to the design presented in the Final Remedy

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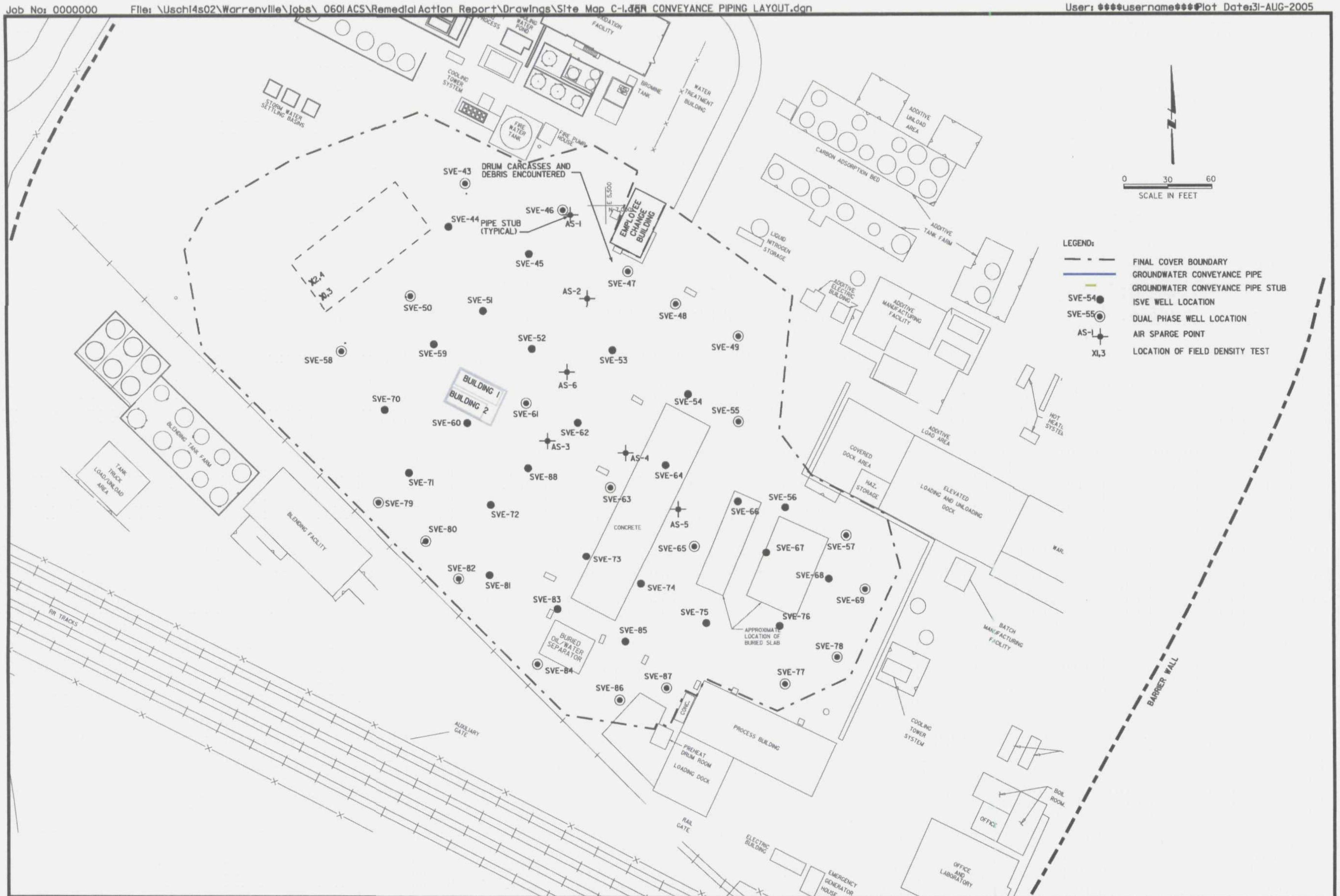

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REMEDIAL ACTION REPORT
SBPA ISVE SYSTEM

FIGURE
8

View of the inside of the SBPA blower shed. Two MWH engineers are shown taking readings from one of the sampling ports on the header system.

was made to avoid damage to the clay layer, which would have occurred if the pipes were placed in trenches.

Two prefabricated buildings were installed in the SBPA to house the system mechanical, electrical, and control equipment. Mechanical equipment associated with the ISVE system (vacuum blower, knockout tank, condensate pump, ISVE piping manifold) are located in Building 1. Electrical and control equipment and mechanical equipment associated with the air sparge system and air supply to the DPE pumps are housed in Building 2. Conveyance piping was installed to connect each ISVE well, DPE well, and air sparge point to the piping manifolds in the system buildings.

To treat the high concentrations of contaminants in the vapor stream anticipated during operation of the ISVE system, a thermal oxidizer and scrubber were installed at the GWTP. The thermal oxidizer and scrubber units were delivered to the site on April 15, 2003. The oxidizer was placed outside the south end of the GWTP building next to the thermal oxidizer installed as part of the Off-Site ISVE system. The scrubber was placed inside the GWTP building. Construction of the system was completed on May 9, 2003 with system start-up beginning on May 12, 2003.

Further discussion regarding the design and construction of the SBPA ISVE system is available in the *Still Bottoms Pond Area In-Situ Soil Vapor Extraction System Construction Completion Report*, (MWH, June 2004).

4.3 BARRIER WALL

4.3.1 Barrier Wall

In February 1997, a continuous Barrier Wall was installed around the ONCA, the ACS operating facility, the OFCA, and the K-P Area to contain the contamination source areas. The Barrier Wall encloses the delineated source areas and buried waste at the

Piping for the SBPA ISVE installed above the clay and geotextile layers.

Same view as above after the interim cover and the system buildings were installed.

Thermal oxidizer on its concrete pad outside the treatment building.

Site. A trencher was used to cut a vertical trench from ground surface to a depth approximately two feet into the confining clay layer at the bottom of the upper aquifer. The trencher placed both a continuous HDPE barrier and a bentonite slurry in the trench to form a barrier completely around the 30-acre ACS Site. The total length of the barrier wall is approximately 4,400 feet. It is keyed approximately two feet into the clay confining layer at the bottom of the upper aquifer, which is located 15 to 25 feet below ground surface (depending upon surface topography). The groundwater extraction system inside the Barrier Wall is discussed in Section 4.4.1.

4.3.2 Separation Barrier Wall

A Separation Barrier Wall was designed and constructed to provide a continuous, vertical, hydraulic cutoff wall to isolate groundwater on the northern side of the site (the On-Site Area) and prevent migration of contaminated groundwater to the southern side of the site (the Off-Site Area) once de-watering efforts were increased.

The 700-foot-long Separation Barrier Wall is keyed two feet into the clay layer underlying the upper aquifer and consists of a mixture of bentonite, soil, and water. It was installed by trenching methods from January 9, 2001 to February 5, 2001. Material testing and quality confirmation measures were taken in accordance with the CQAP (Montgomery Watson, June 1999) to assure that the completed Separation Barrier Wall met the applicable performance requirements. Figure 9 (page 27) shows the location of the Separation Barrier Wall as it aligns with the Off-Site Area.

Further discussion regarding the design and construction of the Separation Barrier Wall is available in the *Separation Barrier Wall Installation Construction Completion Report*, (MWH, March 2002).

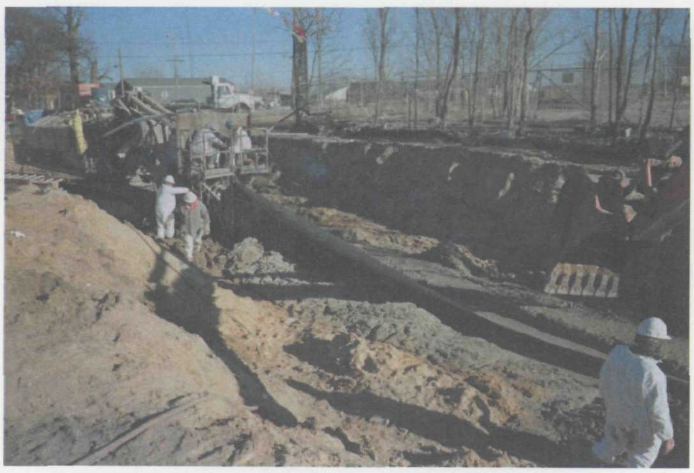
4.4 DEWATERING

4.4.1 Barrier Wall Extraction System

In 1997, MWH installed a continuous Perimeter Barrier Wall around the ONCA, the ACS operating facility, the OFCA, and the K-P Area. That Barrier Wall enclosed the contamination source areas at the Site. A groundwater extraction system inside the Barrier Wall was installed to maintain hydraulic capture within the Barrier Wall. That extraction system is referred to as the BWES. During the first mobilization in 1997, eight 100-foot long extraction trenches were installed. Extraction wells were installed at the end of each trench to collect the groundwater. These extraction wells are numbered EW-10, EW-11, EW-12, EW-13, EW-15, EW-16, EW-17, and EW-18. Water collected by the BWES trenches is piped back to the GWTP for treatment.

A majority of the buried waste at the ACS Site was buried below the water table in the OFCA. Before this waste could be treated by ISVE, the water level in that area needed to be lowered to expose the buried material to air flow. The extraction capacity of the BWES was increased by adding 500 lineal feet of extraction trench. The Final Remedial Design Report specified that the additional 500 feet of trenching be obtained by installing two trenches. One trench (designated as Extraction Trench 20) was 350 feet long, located between the Separation Barrier Wall and OFCA ISVE well field. The second was 150 feet long, designated as Extraction Trench 19, located just south of the existing Extraction Trench 15. These locations were selected because boring logs indicated that these areas had the least potential to encounter buried refuse during construction.

Construction of the new extraction trenches and wells began on December 20, 2000.



Trencher at the south side of the site installing the Perimeter Barrier Wall. The HDPE liner is shown stretched out behind the trencher, with the bentonite slurry along both sides of the liner.

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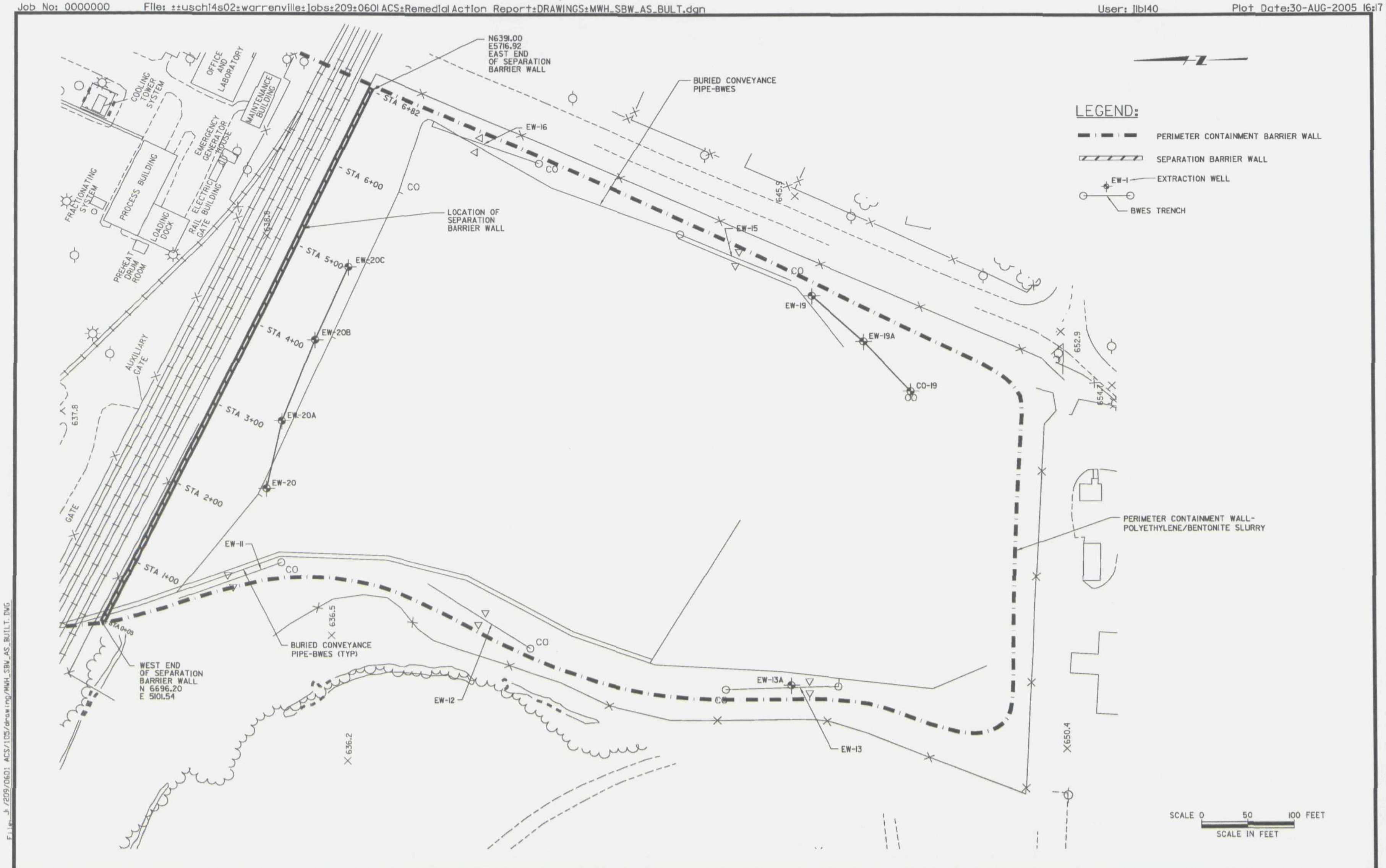

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GRIFFITH, INDIANA

REMEDIAL ACTION REPORT
SEPARATION BARRIER WALL ALIGNMENT

FIGURE 9

Extraction Trench 19 as it was being installed to a depth of 30 feet. The trench is 150 feet long, located 50 feet inside the barrier wall, parallel to Colfax Avenue.

The two new extraction trenches, Extraction Trench 19 and 20, each contain one or more extraction wells. At the same time, a replacement well was also installed in Extraction Trench 13.

Twenty HDPE pipes of various diameters were installed to connect the new BWES extraction wells to the GWTP. The underground piping was installed between February 12 and March 15, 2001. Installation of the pumps, controls, and instrumentation was finalized on November 15, 2001. Figure 10 (page 29) details the BWES complete with the 2001 upgrades.

Further discussion regarding the design and construction of the Barrier Wall Extraction System and its upgrades is available in the *Final Barrier Wall Extraction System Off-Site Area Upgrades Construction Completion Report*, (MWH, March 2003).

Based on the groundwater treatment plant effluent data and groundwater levels collected from within the Barrier Wall, these systems have successfully isolated the source areas of the Site thus preventing further off-site groundwater contamination from occurring. The treatment plant provides active treatment of groundwater from within the Barrier Wall through the BWES and in the north and northwest portion of the Site, outside the Barrier Wall with the PGCS.

4.4.2 GWTP Upgrades

The original GWTP, completed in March 1997, was designed to treat groundwater collected by the PGCS and, to a limited extent, the BWES. In August 1999, MWH began to upgrade the GWTP system to handle the higher levels of organic contamination expected once the dewatering process was initiated inside the Barrier Wall.

The upgrade consisted of four primary components: a gravity phase separator, an aerated equalization tank, an activated sludge plant, and a catalytic oxidizer. Additional pumps, blowers, piping, valves, secondary mixing and/or holding tanks, and controls were added as necessary to achieve the design performance of the upgraded system.

The 38,000-gallon stainless steel gravity phase separation tank, designed to allow the separation of solids and non-aqueous phase liquids (NAPLs), was fabricated on Site from November 1999 to March 2000.

The prefabricated 36,000-gallon steel aerated equalization tank, designed to provide equalization, mixing, and aeration to groundwater flowing through the treatment system, was installed during August 2000 and hydrostatically tested in October 2000.

The activated sludge plant, or "bio tank," designed to biologically treat groundwater via activated sludge contact (i.e., - "bugs"), began treating groundwater collected by the BWES during May 2000.

The catalytic oxidizer and scrubber units, collectively known as the catalytic oxidizer unit or the "cat-ox unit", are two separate units designed to function as one system.

The "Bio Tank" as it was being fabricated in 2000.

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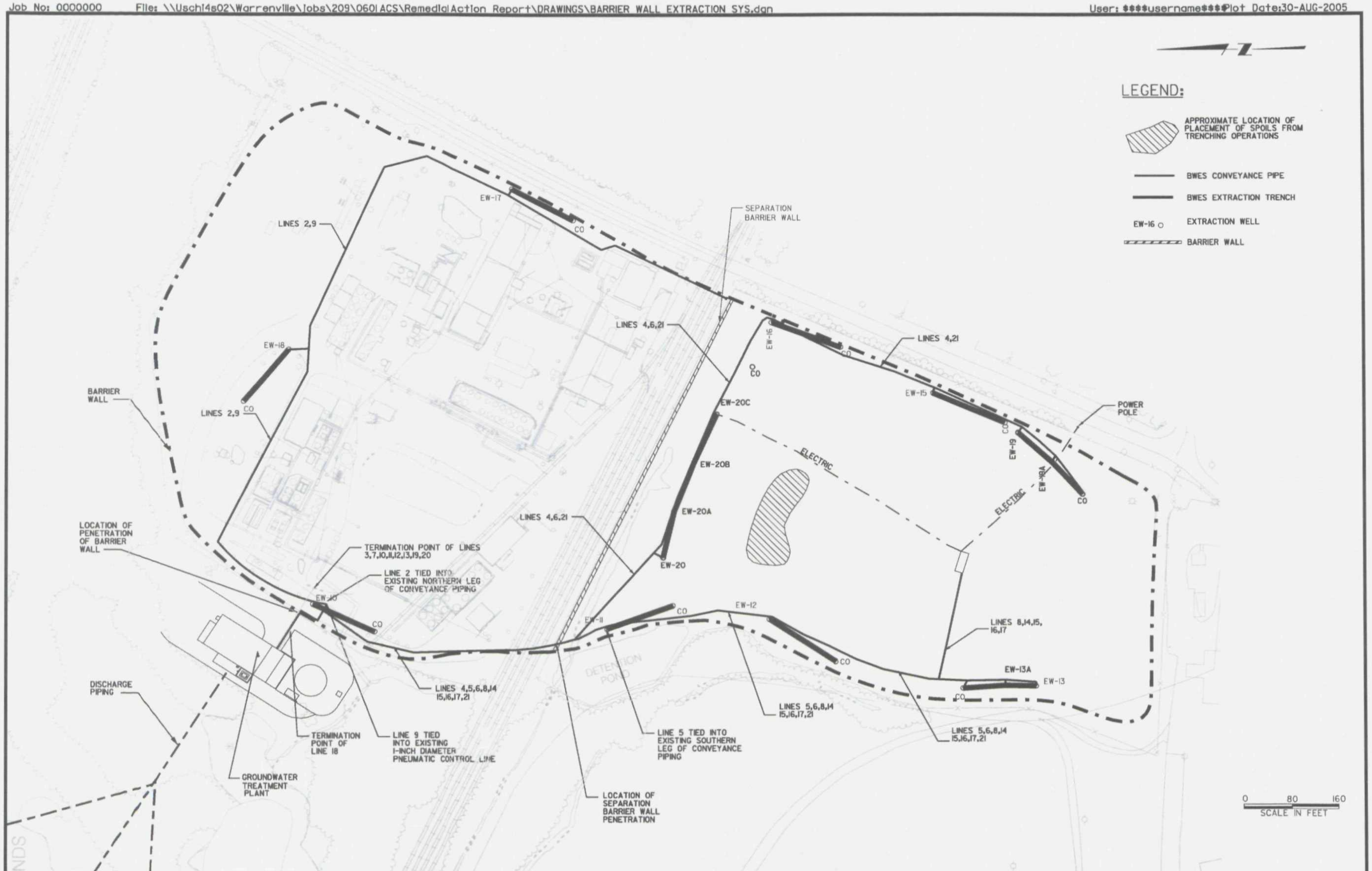

MWH Chicago, Illinois	AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA	REMEDIAL ACTION REPORT BARRIER WALL EXTRACTION SYSTEM	FIGURE 10

The catalytic oxidizer was designed to treat and destroy a minimum of 95 percent of the VOCs contained in the off-gas from the aerated equalization tank. The catalytic oxidizer was installed during July 2000 and began startup testing in January 2001.

The secondary containment system for the activated sludge plant and the aerated equalization tank was constructed during August 1999. The building expansion structure was erected from December 1999 to February 2000.

Initial construction of the upgraded GWTP influent header system began in October 1999. The system was completed in July 2001. During the period in between, interim influent piping was used. Installation of the electrical and instrumentation equipment began in August 2000 and was substantially complete in November 2000. Control systems were optimized throughout January 2001.

The upgraded GWTP system was completed in December 2000 and began operation in January 2001. Figure 11 (page 31) shows the layout of the GWTP after the upgrades were completed. As of September 1, 2005 the GWTP has treated an estimated 54,330,000 gallons of groundwater from the Site.

4.5 CAP/COVER

4.5.1 Interim Off-Site Cover

The Off-Site Area Cover was constructed in two phases: the interim engineered cover and the final cover. The installation was partitioned to allow for installation and optimization of the ISVE system before installation of the FML. This approach was taken to minimize the potential for damage to the liner if repairs or modifications were found to be necessary.

Construction of the Off-Site Area interim cover. A continual stream of dump trucks brought the loads of clean clay into the site. A bulldozer spread the clay in six-inch lifts, which were then compacted by repeated passes

Preparation of the subbase for the interim engineered cover was completed in conjunction with the consolidation of the spoils piles. During May 2001 and June 2001, MWH graded existing soils to create the subbase for the interim engineered cover system. The final subbase topography was contoured to promote surface water drainage. Areas were regraded where necessary to improve stormwater runoff, reduce stormwater run-on, and limit ponding. Swales were incorporated into the subbase grading plan at specified locations to direct surface water runoff towards designated areas.

In early 2001, MWH selected a clay borrow source to obtain clay for the grading of the subbase and installation of the interim engineered cover. Placement and compaction of imported clay began in July 2001 and was completed in August 2001.

The interim engineered cover consisted of 18 inches of compacted clay in the Soil Cover Area (the area outside of the ISVE system area in the northern and eastern portions of the Off-Site Area) topped with 6 inches of topsoil and rootzone material and 12 inches of compacted clay only in the FML Cover Area (the area targeted for treatment by the ISVE system). MWH developed and shaped five drainage swales to manage stormwater runoff. Using pre-existing site contours, MWH designed the drainage swales to slope to the north and the west so that stormwater runoff would flow to the detention pond located in the northwest corner of the Off-Site Area.

At the same time that the interim cover was installed, portions of the final cover were also constructed. In the Soil Cover Area, the compacted clay was covered with approximately 2,500 cubic yards of imported topsoil to a depth of six inches. This topsoil was placed during August 2001 and September 2001. Topsoil was not placed in the future FML Cover Area.

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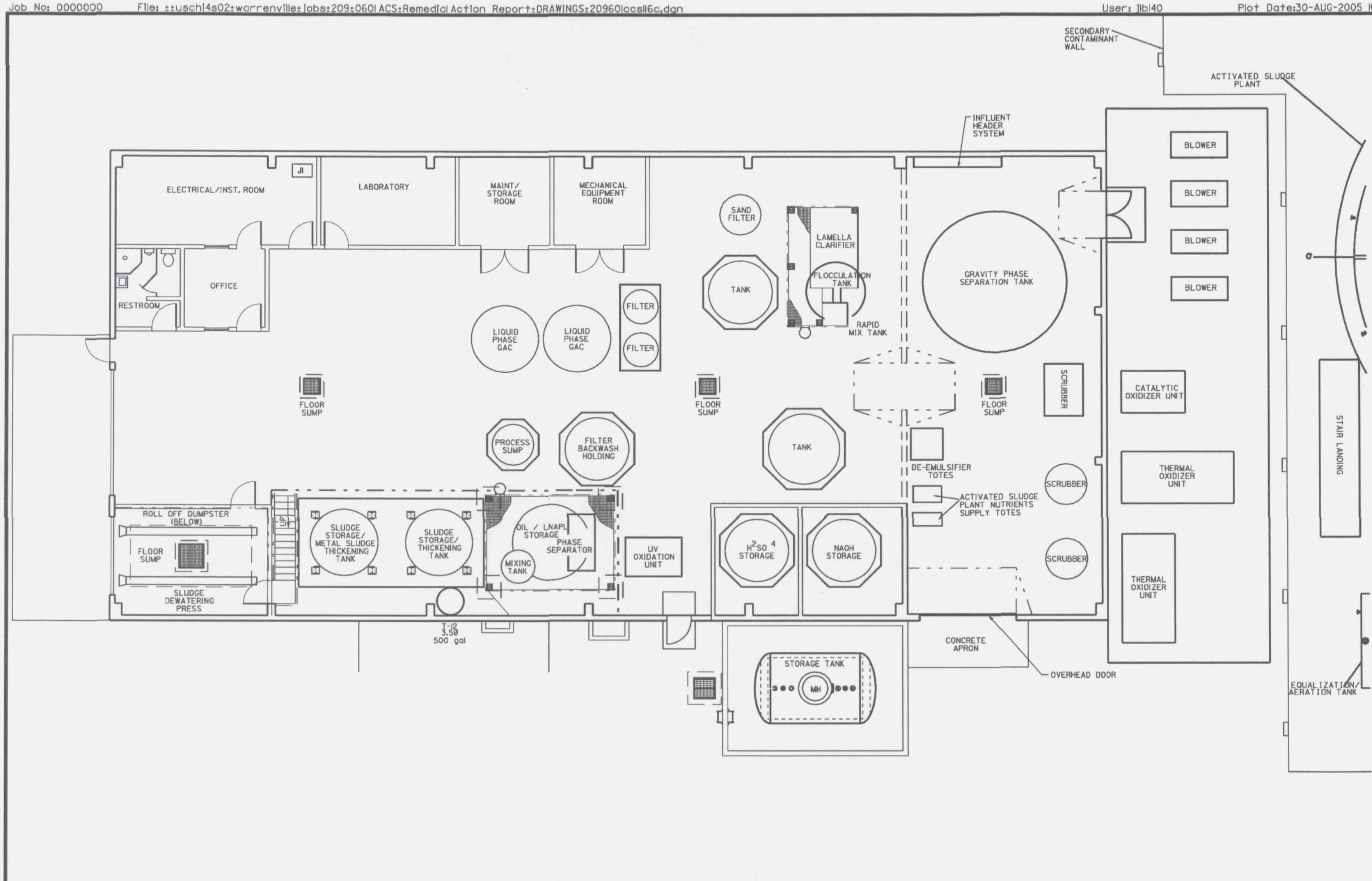

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REMEDIAL ACTION REPORT
GROUNDWATER TREATMENT PLANT
BUILDING LAYOUT

FIGURE 11

Further discussion regarding the design of the interim off-site engineered cover is available in the *Final Off-Site Area Interim Engineered Cover Construction Completion Report* including Spoils Pile Consolidation (MWH, February 2003).

4.5.2 Final Off-Site Cover

The design of the final cover for the Off-Site Area was divided into two distinct areas that would each receive a different engineered cover system. The area that contains buried waste to be treated by ISVE was designated as the FML Cover Area. This area included the OFCA and K-P Area. The cover in this area consists of a 12-inch-thick compacted clay layer (part of the Interim Off-Site Cover) and a flexible 60-millimeter-thick HDPE liner. Twelve inches of root zone, six inches of topsoil, and a vegetative layer were then placed on top of the FML material.

The remaining portion of the Off-Site Area that did not contain buried waste was designated as the Soil Cover Area. This area is not directly treated by ISVE. The cover for this area consists of 18 inches of compacted clay covered with 6 inches of topsoil and vegetation. The area is not covered with the FML. The final off-site cover was installed during the summer and fall of 2002.

Flexible liner being installed over sections in the off-site area. Rolls of the liner materials 23-feet wide and 500-feet long were unrolled using a special forklift attachment.

Further discussion regarding the design of the off-site engineered cover is available in the *Off-Site Area Final Engineered Cover Construction Completion Report*. (MWH, June 2004)

4.5.3 Interim SBPA Cover

Like the Off-Site Area cover, the SBPA cover was constructed in two phases: the interim engineered cover and the final cover. The construction phases were separated so that the SBPA ISVE system could be installed and optimized prior to installation of the final cover. Utilizing a phased approach minimized the potential damage to the final cover if repairs or modifications of the ISVE system were found to be necessary during the startup phase. The interim engineered cover consisted of 12 inches of compacted clay, a geotextile layer, and six to eight inches of compacted gravel.

SBPA ISVE Area after placement and compaction of the gravel layer.

Prior to placement of the clay in the SBPA cover area, groundwater conveyance pipe for the future ISVE system was installed. This included installing the conveyance pipe in the SBPA to extend from the GWTP into the SBPA. Clay for the SBPA interim cover was imported from the same clay borrow source that was used for the Off-Site Area interim cover. After the clay was placed and proper compaction was confirmed, a gravel access road and parking area were constructed by placing a polypropylene non-woven geofabric on top of the clay followed by 12 inches of gravel. The final geotextile and the gravel layer components of the interim cover were installed in May 2003. Placement of the gravel layer included grading and compaction of the gravel. Six to eight inches of gravel were placed across the entire cover area outside of the access road and parking area.

Further discussion regarding the interim SBPA cover is available in the *Still Bottoms Pond Area Interim Engineered Cover Construction Completion Report, including Fire Pond Closure* (MWH, March 2004).

4.5.4 Final SBPA Cover

The final engineered cover was constructed on top of the SBPA interim cover and consists of four inches of low-permeability asphalt. The asphalt was comprised of a material referred to as Modified Asphalt Technology for Waste Containment (MATCON). It is produced by an advanced asphalt technology that combines a proprietary binder with aggregates complying with stringent specifications. The technology provides a durable, high-strength asphalt surface with low permeability. The mix design utilized in the construction of the final cover provided a permeability of 1×10^{-8} centimeters per second (cm/s) in compliance with the standard defined in the Final Remedy.

The first step in installing the final cover was to repair areas of erosion damage that had developed since the interim cover was installed in May 2003. These areas of erosion damage were regraded and general grading was performed to achieve the final design contours. Once the grading was completed, the entire cover area was compacted using a vibratory smooth drum roller. Concrete pads were placed around each ISVE stick-up well in the cover area. On September 8, 2004, herbicide was sprayed on the gravel prior to the placement of the MATCON to minimize the potential effect of weeds growing and damaging the integrity of the asphalt cover.

Placement of asphalt cover to the SPBA ISVE Area.

On September 7, 2004, a pavement test pad was constructed at the Griffith-Merrillville Airport located in Griffith, Indiana. The 20-foot by 200-foot test pad was placed and compacted with a total depth of four inches in order to familiarize the paving crew with the modified asphalt and to perform QA/QC analysis. On September 8, 2004, installation of the asphalt cover in the SBPA began. The installation was completed on September 10, 2004. Based on performance testing conducted during and following construction, the average permeability for the entire SBPA cover was 1.4×10^{-9} cm/s and the average asphalt thickness was measured at 4.3 inches.

Further information on the construction of the SBPA Final Cover is found in the *Still Bottoms Pond Area Final Engineered Cover Construction Completion Report*. (MWH, January 2005).

4.6 GROUNDWATER

There are two groundwater aquifers of interest at the ACS Site: an upper water table aquifer and a lower confined aquifer. The aquifers are separated by a clay confining layer. Groundwater sampling data indicates that benzene and chloroethane are the contaminants of concern in the Site groundwater. Sampling data also indicates that the extent and concentrations of benzene and chloroethane have generally decreased since the remedial actions began in 1996.

4.6.1 Upper Aquifer

Figure 12 (page 34) shows the piezometer and monitoring well locations located in the upper aquifer. The water table elevation in the upper aquifer ranges between 630 and 635 feet amsl. The regional groundwater flow in the upper aquifer

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UPPER AQUIFER MONITORING WELL LOCATIONS

FIGURE 12

Job No: 0000000 File: \\Usch14s02\Warrenville\Jobs\209\0601 ACS\Remedial Action Report\DRAWINGS\Figure 1.dgn User: $$$$username$$$$ Plot Date30-AUG-2005 is generally from east to west. At the ACS Site, the flow is diverted to the north and to the south by the Barrier Wall. The monitoring database from historic investigations indicated upper aquifer impacts extended southeast from the OFCA and north and west from the active ACS facility. Interim actions, including construction of the BWES and PGCS, were completed in 1997 to stabilize the Site and limit further off-site migration of contaminants in the groundwater.

In the upper aquifer, groundwater sampling focused on three impacted areas: North, West, and Southeast, each of which is downgradient of source areas defined within the ACS Site. The purpose was to monitor the boundaries of the contaminant plume and provide early warning of any expanding contamination. Additionally, the interior wells were sampled to look for effects of the BWES and PGCS on containment cleanup.

4.6.2 Lower Aquifer

Figure 13 (page 36) shows the locations of the lower aquifer monitoring wells. The lower aquifer is confined beneath a clay layer. Groundwater flow in the lower aquifer is generally northward. Lower aquifer monitoring was conducted to document upgradient and downgradient water quality, and also to evaluate the groundwater quality trends.

Benzene has been detected at low concentrations in several lower aquifer monitoring wells. In most cases, it appears that the impact was localized – the result of a leaking surface seal in the well itself or a nearby well. Impacts of this type were detected at monitoring wells MW09 and ATMW4D. These wells have been replaced by new wells and subsequent sampling has shown decreasing concentrations.

A lower aquifer investigation is being conducted during August and September 2005 to determine the width of the benzene impact in the lower aquifer at the northern property line and to evaluate the lower aquifer hydraulics to determine the best method to hydraulically contain the impact.

The results of the lower aquifer investigation will be used to assemble a hydraulic control system to inhibit further off-site migration of benzene in the lower aquifer. The previously existing monitoring wells, the new temporary monitoring wells, and the piping installed for the pumping test will all be available as potential components of a cost-effective extraction system that could be designed to achieve hydraulic control over the affected area.

4.6.3 Monitored Natural Attenuation

The 1999 ROD Amendment changed the On-Site groundwater cleanup approach to a containment remedy rather than a restoration remedy. The ESD completed in September 2004 changed the Off-Site groundwater cleanup approach from solely pump-and-treat to a combination of pump-and-treat, ISCO, and MNA.

Pump-and-treat systems have been operated at several locations in the upper and lower aquifer over the past ten years. The PGCS has captured impacted groundwater in the upper aquifer since 1997. Individual pumps have been operated in three lower aquifer monitoring wells, MW09r, MW10C, and MW53 to remove localized concentrations of benzene. The pumping will be continued until concentrations are reduced and the impact areas can be transitioned to MNA for the long term.

Section 1.3.7 of this report describes the treatment of the upper aquifer in the South Area by chemical oxidation technology. Three full-scale applications have been made to treat residual hydrocarbons trapped in the water table smear-zone. Post-application sampling shows that the hydrocarbon concentrations in the smear-zone have been significantly reduced and that downgradient groundwater quality has improved. Benzene concentrations have ranged as high as 6,000 ppb in MW06, the monitoring well that best represents contaminant leaching from the smear-zone. Benzene was not detected in the sample from the March 2005 groundwater sampling event.

In the short term, the pump-and-treat systems will continue to remove contaminants from the groundwater and to provide hydraulic control (containment) of groundwater impact areas. In the longer term, results from the semiannual sampling events under the long-term monitoring program will aid the U.S. EPA and IDEM in making the decision to transition fully to MNA.

4.6.4 Chemical Oxidation

During investigations in 1996, benzene impact in the groundwater was found to extend more than 1,500 feet south from the ACS site in the upper aquifer. The Barrier Wall, which was installed in 1997, isolated the

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original source of the impact. Pilot studies were conducted in both the north and south area to evaluate the potential for ORC to reduce residual hydrocarbons in the water table zone outside the barrier wall.

An ORC Pilot Study was conducted in the North Area in 1999. The immediate results were inconclusive because of seasonal variability in groundwater flow direction. However, by 2004, the concentrations of the contaminant of concern had decreased by more than an order of magnitude. Therefore, it was decided to continue remediation there by pump and treat technology that is being provided by the PGCS.

Because the north area pilot study was inconclusive, a second pilot study was conducted in the South Area in 2001 to evaluate the potential for ORC to treat water table zone outside the barrier wall there. While the ORC was effective in reducing benzene concentrations in the plume on the short term in the South Area, it did not appear to be sufficiently aggressive to destroy the residual organic compounds in the smear zone. Therefore, a more aggressive in-situ oxidation technology was pilot tested. The results were positive and so MWH developed a phased approach for using modified Fenton's Reagent to treat the smear zone in the south area. The goal of the ISCO Treatment was to remediate the groundwater plume to the south of the ACS Site by reducing or eliminating the mass of organic compounds in the smear zone near the intersection of Colfax Avenue and Reder Road.

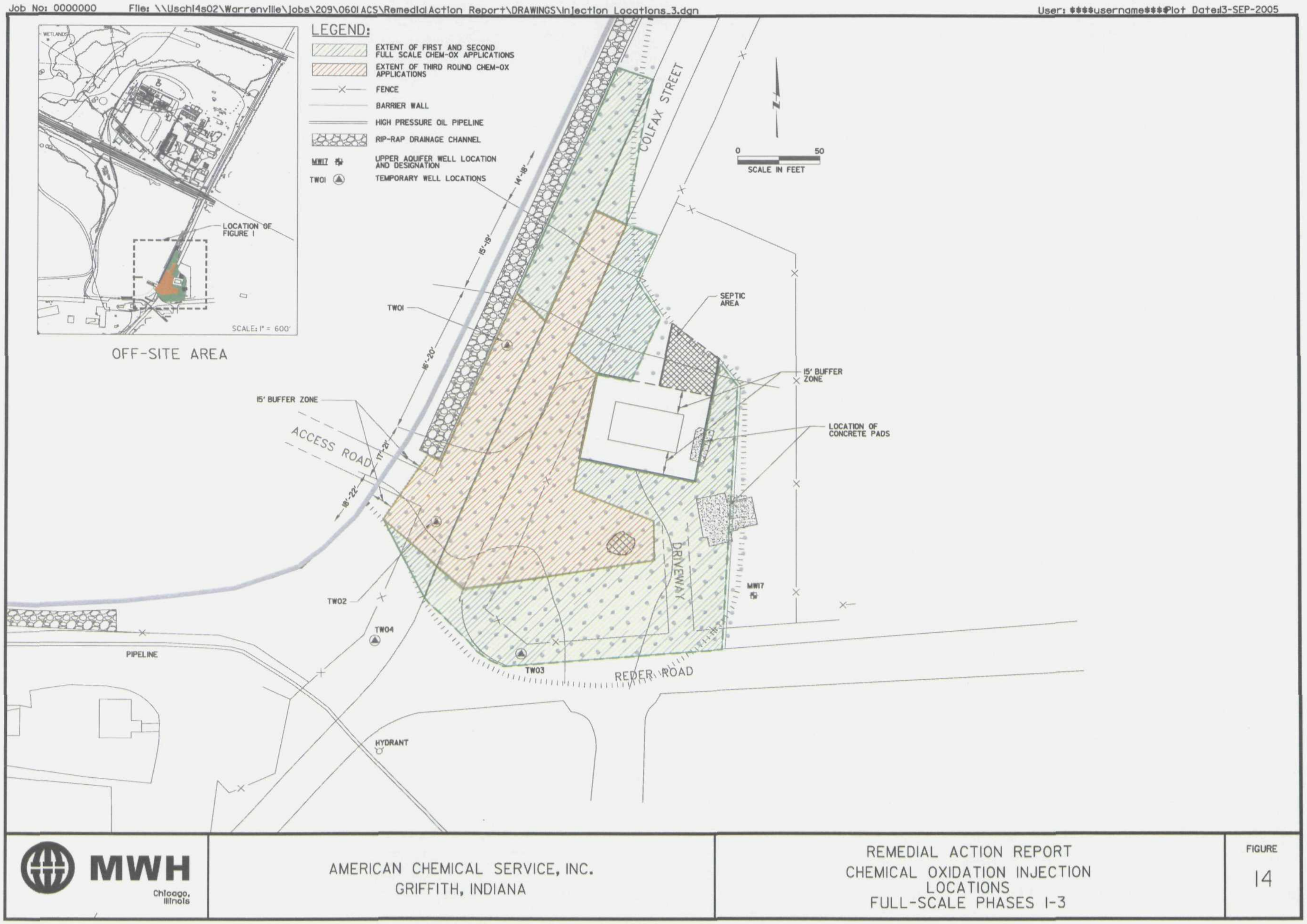
Three full-scale Chem-Ox injections have been completed. The first full-scale injection was completed in September 2004, the second was completed in April 2005, and the third was completed in August 2005. Approximately 450 gallons of reagent were injected at each of the 420 borings in both the first and second full-scale injections.

Due to the decrease in concentrations and the overall low concentrations observed in samples collected from the upgradient edge of the smear zone during the post-application sampling events of the first two injections, MWH proposed to target the areas of highest concentrations, closer to the ACS Site for the third application. Approximately 450 gallons of reagent were injected at each of 209 borings in the third application. Figure 14 (page 38) highlights the area where the chemical oxidation applications have occurred, as well as the location of injection points for each round.

Portion of the treatment array with injection points located along Colfax Avenue during Phase I of the chemical oxidation application.

Post-application sampling of the third application will occur in October 2005. Once the sampling results are received and have been validated, MWH will submit a report to summarize the results and recommend further action, if necessary, to transition to a monitored natural attenuation remedy.

Results at monitoring well MW45 have decreased to non-detectable levels since the Barrier Wall was completed indicating that the primary source of groundwater contamination has been cut off. However, benzene concentrations are still elevated in monitoring well MW06 screened in the upper aquifer close to the site. This indicates that there is still some residual contamination in the smear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LEGEND:
EXTENT OF FIRST AND SECOND FULL SCALE CHEM-OX APPLICATIONS
EXTENT OF THIRD ROUND CHEM-OX APPLICATIONS
FENCE
BARRIER WALL
HIGH PRESSURE OIL PIPELINE
RIP-RAP DRAINAGE CHANNEL
MW17 UPPER AQUIFER WELL LOCATION AND DESIGNATION
TW01 TEMPORARY WELL LOCATIONS
LOCATION OF FIGURE 1
SCALE: 1" = 600'
OFF-SITE AREA
SCALE IN FEET
COLFAX STREET
SEPTIC AREA
15' BUFFER ZONE
LOCATION OF CONCRETE PADS
ACCESS ROAD
DRIVEWAY
REDER ROAD
PIPELINE
HYDRANT
TW01
TW02
TW03
TW04
MW17
AMERICAN CHEMICAL SERVICE, INC.
GRIFFITH, INDIANA
REMEDIAL ACTION REPORT
CHEMICAL OXIDATION INJECTION LOCATIONS
FULL-SCALE PHASES 1-3
FIGURE
14
MWH
Chicago, Illinois

zone above the water table in the upper aquifer, at the south side of the Site.

4.6.5 Soil Vapor

Several investigations in the upper aquifer have been conducted at the ACS Site near the intersection of Reder Road and Colfax Street. At the request of the Agencies, MWH evaluated the potential that soil vapors near the house, located at 1002 Reder Road, might contain VOCs that have migrated from the smear zone. Following the U.S. EPA's *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (Draft Guidance, November 2002), MWH determined that concentrations of VOCs, specifically benzene, in the soil and groundwater in the smear zone near the house were elevated enough to warrant collection of soil vapor samples.

On August 30, 2004, after approval of the plan by the Agencies, soil vapor sampling was conducted to determine if organic compounds were present in the shallow soil vapor near the house. MWH collected four soil vapor samples in the vicinity of the house. Due to probable interference from a natural gas leak at the residence, the results of the initial soil vapor investigation were considered anomalous and a second phase of soil vapor investigation was recommended. This second phase included an additional house inspection and indoor air sampling event, as well as the installation of a precautionary vapor mitigation system. This system is similar to a radon mitigation system, and will prevent potential intrusion of possible organic vapors into the house. Coordinated with the owner of the property, the vapor mitigation system was installed in February 2005.

After the mitigation system had been operating for approximately six weeks, MWH collected an indoor air sample from the basement of the home. MWH conducted an inspection of the house with the focus of identifying and removing from the basement any potential chemicals (cleaners, glues, fuels, etc.) that could possibly interfere with indoor air samples. An ambient air sample was collected outside the house during this event.

The analytical results of the indoor air samples indicated that concentrations were not sufficiently high to warrant actions beyond the installation of the precautionary vapor mitigation system. The system will be effective in preventing potential vapor intrusion.

5.0 HEALTH AND SAFETY

Health and Safety has been a continual focus in the ACS project since the beginning of the investigations in 1988, through the completion of remedial construction and on into the future for the Operations, Maintenance, and Monitoring program.

A Site Safety Plan was developed for the first phase of investigation during the Remedial Investigation. This plan has been amended and modified to cover new Site activities as the investigations continued, and it has been modified for remedial construction activities that were started in 1996. The following are key components of the comprehensive safety focus maintained throughout the project.

- All MWH employees are required to read the applicable Health and Safety Plan or Safety Plan amendment before working at the ACS Site
- All MWH staff working at the ACS Site must provide documentation of completion of the 40-hour Occupational Safety and Health Administration (OSHA) Hazwoper training and an up-to-date eight-hour refresher course.
- All MWH staff working on the Site must provide documentation that they are part of a medical monitoring program.
- All subcontractors working on the Site are required to develop their own Health and Safety Plan for the specific work that they conduct at the Site. They are required to provide a copy to MWH before starting work.
- Prior to starting work, all subcontractors must provide written documentation that their on-site workers are up-to-date on OSHA Hazwoper training and medical monitoring.
- During times when construction activities were being conducted over several weeks or months, weekly Health and Safety meetings were conducted with members of the various work crews.
- Each workday was started with a tailgate safety meeting for each investigation or construction work crew.

Lee Orosz, the manager of the GWTP is the designated Site Safety Officer for the project. Lee is a full-time MWH employee and he is on site full time each week, except during holidays and vacation.

Approximately one-half of the investigative work and remedial construction has been conducted on the active ACS facility. Lee Orosz communicates regularly with Tom Froman, Health and Safety Coordinator for ACS Inc., to coordinate activities and be sure that ACS employees are aware of MWH activities planned for the Site and that MWH employees and subcontractors are aware of activities that ACS is planning on the site. In addition, any MWH employees or subcontractors that will be working on the ACS Site participate in the ACS Inc. Safety Training program, prior to working on the facility.

The Health and Safety statistics for the ACS Site as of September 22, 2005 are:

- 3,008 consecutive days with no lost time due to an accident or H&S incident.
- 731 consecutive days without an incident requiring first aid.

These statistics are indicative of the emphasis that has been placed on health and safety throughout the project. During tasks spanning predesign investigations to design and construction, MWH has worked to maintain focus on safety and minimize the potential for workers at the site to become complacent.

The agenda for each weekly construction meeting included a site safety review. In the review, each worker was encouraged to report on near misses and potentially dangerous situations they observed during the previous week and also to anticipate how the activities planned for the next week might lead to unsafe or dangerous conditions.

MWH's response to a near miss reported on May 7, 2003, provides an example of how the safety focus is maintained at the site. On that date, an MWH technician was collecting water levels at a set of monitoring wells inside the barrier wall to document the progress of site dewatering. It was a routine activity that this technician had been conducting twice a month for the past year, using the same equipment and following the same procedures.

However upon completing the measurements on this date, the technician felt dizzy and disoriented. Nevertheless, he drove home. When his wife observed his condition, she expressed concern and asked him to report his condition to his supervisor. Upon hearing about it that evening, the Project Manager, Peter Vagt strongly recommended that he go to his doctor or the local emergency room for a physical check up. The technician did go to the emergency room that evening and then went in for a follow-up evaluation one week later.

In addition, the Project Manager called a Root Cause Analysis Meeting to discuss the event, develop a map of potential causes, and implement corrective actions. The technician attended the meeting, as well as the Project Manager, the site safety officer, a meeting facilitator and the engineer and scientist who had developed the work plan and used the collected data.

The meeting was specifically planned and conducted so that the technician did not feel blamed for the event. Rather, the goal was to examine the planning and the management of the project to identify the root causes within the MWH project structure that led to the event. As a direct result of the meeting, a new work plan was developed to more fully define the work and a health and safety addendum was developed to clarify personal protective levels required during varying site conditions.

Indirect goals of the meeting included heightening the awareness of safety on the project and "sending the message" that reporting on potential or real safety events is the correct course of action and that no blame will be placed on the reporting person.

6.0 FINAL INSPECTION AND DOCUMENTATION

As has been noted in Section 4.0, as each major component of the remedy has been completed, a CCR has been prepared and submitted to the Agencies. The CCRs typically have provided information regarding chronology of the construction activities, equipment specifications, and as-built figures. These CCRs have been reviewed and approved by the EPA. Table 2 provides a summary of the total capital cost tasks and the corresponding document or action that addresses completion of the task.

The EPA and IDEM conducted a pre-final inspection at the ACS site on September 23, 2004 and determined that the remedial systems were constructed and operating as designed. A punch list of minor tasks that were yet to be completed was developed at that time and provided to the ACS Potentially Responsible Parties (PRP) group. The punch list and the actions implemented to address each item are provided in Table 3.

The Preliminary Close-out Report (PCOR) was issued by the EPA in September 2004. That Report stated that, based on the EPA and IDEM's review during the pre-final inspection, the remedial action was constructed and operating as designed. The PCOR certified that the ACS site meets the criteria for designation as a construction completion site.

The final inspection was held on September 22, 2005. Representatives of EPA, IDEM, the ACS PRP Group, and MWH were present at the inspection. A review of the punch list created during the pre-final inspection indicated that all tasks had been completed. No other major issues were identified.

7.0 OPERATION & MAINTENANCE AND MONITORING ACTIVITIES

7.1 OPERATION AND MAINTENANCE ACTIVITIES

Operation and maintenance (O&M) of the remedial systems is an ongoing task that began with the completion of each of the components of the *ROD*. A full-time operator is present on Site to perform O&M activities. Major activities are reported to the EPA and IDEM regularly through monthly status reports and during monthly O&M meetings.

A brief description of the O&M activities associated with major components of the ROD are described below.

7.1.1 ISVE Systems

O&M activities associated with the ISVE systems are performed in accordance with *Operation & Maintenance Manual, ISVE Systems* (MWH, March 2005). Regular activities include evaluation of equipment operation, routine maintenance of equipment, and responding to system alarms or shutdowns. Samples are collected monthly to ensure that the thermal oxidizers are complying with the established performance criteria.

7.1.2 Dewatering Systems

O&M activities associated with the GWTP are performed in accordance with the *Operations & Maintenance Plan/Contingency Plan* (MWH, July 1997) and subsequent addenda. Regular activities include evaluation and maintenance of pumps installed in the BWES trenches, DPE wells, as well as in the PGCS wells. Routine maintenance is performed on the many components of the groundwater treatment system. Samples are collected monthly to ensure that the GWTP is performing within design standards and that the effluent stream does not exceed established criteria.

7.1.3 Engineered Covers

Routine inspections of the SBPA and Off-Site covers are performed to verify that they retain low permeability characteristics. The vacuum level and air flow through the ISVE system are monitored regularly to ensure integrity of the cover, inspections of the cover are conducted on a quarterly basis and after storm events to identify cracking or erosion, and water levels are measured in wells and piezometers to document the reduced water levels within the capped areas. If deficiencies are noted, remedial actions are completed to address them.

7.2 MONITORING ACTIVITIES

Monitoring of the remedial systems is performed in order to verify the ongoing remedial systems are meeting their design objectives. The performance requirements for the ISVE systems, GWTP, Dewatering/ Containment, and Chemical Oxidation that are necessary to effectively achieve the design objectives for each system are discussed below.

7.2.1 Groundwater

Groundwater monitoring activities are currently performed in accordance with the *Revised Long-Term Groundwater Monitoring Plan* (MWH, September 2002). Under the current monitoring plan, groundwater sampling occurs on a semi-annual basis. Sixteen upper aquifer wells and 16 lower aquifer wells in the monitoring network are analyzed for indicator parameters: benzene, chloroethane, tetrachloroethene, trichloroethene, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethane, and vinyl chloride. Semi-volatile organic compounds (SVOCs) and metals are sampled from selected wells on an annual basis. A full-scan of Target Compound List/Target Analyte List (TCL/TAL) parameters will be analyzed for in 2006. In order to confirm that the BWES and PGCS are affecting the upper aquifer as planned, water level measurements are collected on a quarterly basis.

The groundwater sampling data demonstrates that the BWES is working to contain contaminants inside the Barrier Wall. Results from several monitoring wells outside the Barrier Wall, but inside the impacted groundwater zones, show that concentrations in contaminated groundwater areas are decreasing. Results from upgradient, downgradient and side-gradient monitoring wells have been consistently free of Site-related contaminants, indicating that contamination outside of the Barrier Wall has not migrated beyond its historical extent. These results also indicate that the PGCS has been effective in preventing further off-site migration of contaminants in the groundwater. While some concentrations have shown variability, no upward trends exist. Most results are consistently below baseline values and some show decreasing concentration trends.

7.2.2 Residential Groundwater

The *Revised Long-Term Groundwater Monitoring Plan* (MWH, September 2002) includes a sampling plan for the residential groundwater wells located near the ACS Site. Five residential wells along Reder Road at the south side of the Site are sampled annually for low concentration full-scan (TCL/TAL) parameters. These wells will continue to be sampled during the third quarter of each year. To date, no Site-related contaminants have been detected in the private wells. The sampling has indicated that water quality in the private wells in the vicinity of the ACS site consistently meets drinking water standards.

7.2.3 Off-Gas Treatment Systems

Compliance monitoring of the catalytic and thermal oxidizers is necessary to determine if off-gas emissions generated are allowable under the IDEM Air Permit Equivalency. Compliance monitoring consists of sampling and analyzing the inlet and outlet vapor streams of the catalytic and thermal oxidizers to determine if emissions are in compliance with IDEM regulations and to determine the overall destruction capacity of the oxidation units.

The samples are collected via Summa canisters and submitted to the laboratory for VOC and SVOC analysis via U.S. EPA methods TO-14 and TO-13. Collection of the effluent sample is not required when the thermal oxidation treatment process is not operational.

The performance standards for the treatment of off-gas are as follows:

- IDEM Air Quality standards as specified in Rule 326 Indiana Administrative Code [(IAC) 2-1-1(b)(3)(A)]; which states that the VOC emissions cannot exceed 3 pounds per hour or 15 pounds per day or 25 tons per year. Any contaminant detected via analytical method TO-14 and TO-13 will be used in calculating the pounds per hour and pounds per day. The off-gas flowrate will be determined using US EPA Method C.

The ROD requires that the excess cancer risk from off-gas emissions cannot exceed the 1×10^{-4} to 1×10^{-6} range for nearby residences or site workers.

7.2.4 GWTP Effluent

Compliance monitoring for the GWTP will continue to be conducted in accordance with the *Performance Standard Verification Plan* revised in the *Quality Assurance Project Plan* (MWH, November 2001).

In addition to the effluent samples, a sediment sample is collected near one of the effluent discharge structures in the wetlands to assess whether or not PCBs are accumulating as a result of the discharge. A sample is collected once per year for this purpose. There is no specific criterion or performance standard with which to compare the analytical data, but the data is evaluated to see if there is a definitive increasing trend.

Analyte	Frequency
Flowrate and pH	Continuous
BOD, TSS, SVOCs, and Metals	Once per quarter
VOCs	Once per quarter
PCBs	Once per quarter
PCBs in Sediment (one location)	Annually

The schedule of the sampling frequency and parameters for process monitoring are shown in the table above.

7.2.5 ISVE Systems

Performance monitoring is conducted to evaluate and optimize the ISVE systems in the SBPA, and the OFCA and K-P Areas. Performance monitoring consists of:

- Site conditions, such as temperature, relative humidity, atmospheric pressure and general weather conditions recorded on a regular basis to aid in determining factors that affect overall system performance,
- Gas flow rates at the individual ISVE wells, headers, catalytic oxidation units, and the discharge stack, as necessary to ensure the system is operating as intended.
- Vacuum at the individual ISVE wells, headers, blowers, and silencers, as necessary to evaluate capture of vapors,
- Gas temperature before and after the ISVE blowers,
- Natural gas consumption of the catalytic oxidation unit; and
- ISVE well water levels to determine: 1) if free product is present in the wells and its recoverability and 2) if the dewatering level is being maintained.

7.2.6 Dewatering Systems

In order to gauge the effectiveness of the dewatering efforts, periodic water level measurements are conducted on one-third of the ISVE wells. The measured wells are considered representative based on their location within their respective ISVE systems.

Area	Water Level Gauging Points
Kapica-Pazmey Area	SVE-1 SVE-4 SVE-8 SVE-10
Off-Site Containment Area	SVE-13 SVE-15 SVE-18 SVE-20 SVE-24 SVE-29 WVE-31 WVE-34 SVE-37 SVE-40
Still Bottoms Pond Area	SVE-44 SVE-46 SVE-49 SVE-53 SVE-56 SVE-59 SVE-62 SVE-65 SVE-69 SVE-72 SVE 73 SVE-77 SVE-79 SVE-82 SVE-86

In addition, existing BWES monitoring points are continually measured to confirm that a hydraulic capture zone within the barrier wall is maintained.

Area	Water Level Gauging Points
BWES Paired Piezometers	P93/P94 P95/P96 P97/P98 P99/P100 P101/P102 P103/P104 P105/P106 P107/P108
Additional Monitoring Points	P29 P31 P32 P36 P49

The water level data is used to generate upper aquifer groundwater contour maps for evaluating the capture zone of the extraction trenches and dual-phase extraction wells. In addition to water level measurements, the flowrate of groundwater extracted from the operational trenches and extraction wells is monitored to assess the performance of the dewatering system.

8.0 SUMMARY OF PROJECT COSTS

Consent Decree EPA ID	Capital Construction Activities [1]	Total Cost
1	**Site Preparation and Cleanup**	
1.a.	Close Firepond	$11,549.52
1.b.	Spoils Pile Consolidation	$10,419.05
1.c.	Drum/Waste Removal in On-Site Containment Area	$1,063,993.06
1.d.	PCB Soil Excavation from Wetland	$398,380.63
1.e	General Groundwater Remediation	$842,334.92
1.e.1.	ORC Treatment of Groundwater in North Area	$3,607.17
1.e.2.	ORC Treatment of Groundwater in South Area	$281,109.40
1.e.3.	Chemical Oxidation in South Area	$1,627,617.73
1.e.4.	Lower Aquifer Investigation	$287,463.75
2	**In-Situ Soil Vapor Extraction (ISVE)**	
2.a.	ISVE Installation - Off-Site Containment Area	$1,134,707.43
2.b.	ISVE Installation - Kapica Pazmey Area	$398,083.00
2.c.1	O&M of Off-Site ISVE System for 1st 12 months	$420,350.30
2.c.2	O&M of Kapica Area ISVE System for 1st 12 months	$127,482.72
2.d.	ISVE Installation - Still Bottoms Pond Area	$1,601,975.90
2.e.	O&M of Still Bottoms Pond System for 1st 12 months	$630,769.16
3 & 4	**De-Watering/Barrier Wall**	
3.a.	Groundwater Treatment Plant Upgrade	$2,569,382.67
3.b.1.	Barrier Wall Extraction System Upgrades Off-Site	$436,047.98
3.b.2.	Barrier Wall Extraction System Upgrades On-Site	$200,869.78
3.b.3.	De-Watering Groundwater Treatment System	$2,205,239.41
3.c.	De-Watering Groundwater Treatment System	$30,942.29
4.a.	Barrier Wall Between On-Site and Off-Site Areas	$268,299.04
5	**Cap/Cover**	
5.a.	Temporary Off-Site Area	$396,163.96
5.b.	Final Off-Site Area	$1,197,139.67
5.c.	Temporary On-Site Area	$487,160.98
5.d.	Final On-Site Area	$830,939.89
	Capital Cost Subtotals:	$17,462,029.41
6.b. & B.9	**Project Management Activities**	$913,719.50
	Management Subtotals:	$913,719.50
	Operation & Maintenance Costs [2]	
B.1,2,3,4	PGCS Groundwater Treatment System	$634,996.23
B.1	O&M of the PGCS Groundwater Treatment System	$112,637.75
B.2 and B.3	O&M of Off-Site ISVE System for first 12 months: Chemicals/Parts/Services	$15,048.88
B.2, B.3 & B.4	O&M of Off-Site ISVE System for first 12 months: Chemicals/Parts/Services	$276,076.06
B.5.	Cover Inspections & Maintenance	$12,157.65
B.7.	Groundwater, Air Quality, Wetland Area Monitoring	$614,357.06
B.8.	Residential Well Sampling	$53,153.88
B.6,7,8	Groundwater, Air Quality, Wetland Area Monitoring	$0.00
B.1,2,3,3	O&M Reporting	$2,212.85
B.1,2,3,4	Treatment System Monitoring	$134,554.69
B.1,2,3,4, 7	O&M for PGCS GWTP, Groundwater Monitoring	$17,145.11
	O&M Subtotals:	$1,872,340.16

Notes: [1]Costs for Capitol Construction Activities are current as of September 1, 2005.
[2]Operating and maintenance costs are current as of September 1, 2005. Fill costs are not represented here. O&M is anticipated to continue for many years.

9.0 OBSERVATIONS AND LESSONS LEARNED

The intent of this section of the report is to highlight successes and challenges encountered in the implementation of the RA. Feedback was sought from all parties (EPA, IDEM, Black & Veatch, PRP Group Members, and MWH team members). The items listed below were provided by the project team members:

- Execution of the construction of the RA components utilizing a Design-Build approach allowed flexibility in completing the work and in application of creative approaches to even the most routine tasks.
- Open lines of communication through consistent updates and regular meetings (weekly during construction activities), was vital.
- Utilization of qualified, local subcontractors provided flexibility during implementation of the various components of the RA.
- Maintenance activities associated with the thermal oxidizers have been challenging. The extreme contaminant loading into the oxidizers and associated scrubbers has consistently degraded various mechanical components (pH and conductivity probes, pumps, etc.). The vapor stream has also been observed to damage the steel structure of the scrubbers despite utilization of highly resilient alloys.
- MWH consistently performs routine maintenance activities and repairs to ensure that oxidizers and scrubbers continue to operate and meet their performance criteria.
- Continuous evaluations into health and safety protocol and procedures were vital for the Site's successful history of operations.
- The project team consistently communicated progress of the construction activities through regular one-page Field Updates. Paper copies of each of 24 Updates were sent out to approximately 300 people who had requested them during the Public Meeting.
- Site tours to local groups including the Boy Scouts, the Griffith Fire Department, and church groups have been made available. Throughout the project, concerns that affect the community have been addressed. For example, in response to concerns raised by neighboring residents, MWH constructed a noise abatement structure over the GWTP's aeration blower.
- Consistent enforcement of health and safety rules for all aspects of the construction was crucial to ensure the safety of the all team members. The result was over 3,000 consecutive days with no lost time due to a health and safety incident. In response to one incident involving an MWH employee, project activities were immediately ceased to allow the team members to attend an incident debriefing and analysis. This session emphasized that the Site is more dynamic than it appears and that complacency in executing regular tasks presents definite risks to the safety of personnel.
- Members of the ACS Technical Committee were included in planning and review. This led to significant progress with respect to the technical aspects of the project and promoted better interaction with the Agencies.
- Re-evaluation of the feasibility of the proposed remedy resulting in the implementation of interim remedial actions has been critical to delivering a remedial design and construction ahead of schedule and well below original cost estimates.

10.0 CONTACT INFORMATION

The PRP's used the following contractor for the RA:

Peter Vagt, Ph.D., CPG - Project Manager
Joseph D. Adams, Jr., P.E. - Project Coordinator
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The U.S. EPA used the following contractor for oversight of the RA activities:

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The Remedial Project Managers for the EPA were:

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The Project Managers for IDEM were:

Prabhakar Kasarabada (c. 2002-present)
Sean Grady (c. 2000-2002)
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100 North Senate Avenue
Indianapolis, Indiana 46204-2241
317-234-0352

11.0 REFERENCES

The detailed Administrative Record, including the documents referenced here, can be examined at the following locations:

Griffith Public Library
940 North Broad Street
Griffith, IN 46319
219-838-2825

Griffith Town Hall
111 North Broad Street
Griffith, IN 46319
219-924-7500

Record of Decision (ROD), U.S. Environmental Protection Agency, September 1992.

Consent Decree, U.S. Environmental Protection Agency, January 2001.

Petition for ROD Amendment, Montgomery Watson, July 1994.

ROD Amendment, U.S. Environmental Protection Agency, July 1999.

Explanation of Significant Differences. U.S. Environmental Protection Agency, September 2004.

Preliminary Close-out Report, U.S. Environmental Protection Agency, September 2004.

Remedial Investigation Report (RI), Warzyn Inc., June 1991.

Final Report Feasibility Study (FS), Warzyn, Inc., June 1992.

Management and Temporary Storage of Construction Derived Soils, Montgomery Watson, November 1996.

Operations & Maintenance Plan/Contingency Plan, Montgomery Watson, July 1997.

Buried Drum Removal Plan, Montgomery Watson, January 1999.

Field Sampling Plan (FSP), Montgomery Watson, April 1999.

PCB-Impacted Soil Excavation Work Plan, Montgomery Watson, April 1999.

Construction Quality Assurance Plan (CQAP), Montgomery Watson, June 1999.

Performance Standard Verification Plan (PSVP), Montgomery Watson, June 1999.

Site Safety Plan (SSP), Montgomery Watson, June 1999.

Final Remedial Design Report, Final Remedy, Montgomery Watson, August 1999.

Close Out Procedures for National Priorities List Sites, Office of Emergency and Remedial Response, U.S.EPA 540-R-98-016, 3 January 2000.

Quality Assurance Protection Plan (QAPP), MWH, November 2001.

Separation Barrier Wall Installation Construction Completion Report, MWH, March 2002.

Revised Long-Term Groundwater Monitoring Plan, MWH, September 2002.

Final PCB-impacted Soil Excavation In the Wetland Area Construction Completion Report, MWH, November 2002.

Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils, U.S. EPA Draft Guidance, November 2002.

Final Off-Site Area Interim Engineered Cover Construction Completion Report including Spoils Pile Consolidation, MWH, February 2003.

Final Barrier Wall Extraction System Off-Site Area Upgrades Construction Completion Report, MWH, March 2003.

Final Buried Drum Removal in On-Site Containment Area Construction Completion Report. MWH, March 2003.

Off-Site Containment Area and Kapica-Pazmey Area In-Situ Soil Vapor Extraction Systems Construction Completion Report. MWH, March 2004.

Still Bottoms Pond Area Interim Engineered Cover Construction Completion Report, including Fire Pond Closure, MWH, March 2004.

Off-Site Area Final Engineered Cover Construction Completion Report, MWH, June 2004.

Still Bottoms Pond Area In-Situ Soil Vapor Extraction System Construction Completion Report, MWH, June 2004.

Superfund Preliminary Close-out Report American Chemical Service, Inc. Site, U.S. EPA, September 2004.

Still Bottoms Pond Area Final Engineered Cover Construction Completion Report, MWH, January 2005.

Operation & Maintenance Manual, ISVE Systems, MWH, March 2005.

Health and Safety Field Manual, MWH, June 2005.

Table 1

Groundwater Treatment System Effluent Discharge Limits

Quality Parameter	Effluent Standard (Limit)
General Water Quality Parameters	
pH	6 - 9 S.U.
BOD-5	30 mg/L
TSS	30 mg/L
Inorganics	
Arsenic	50 µg/L
Beryllium	NE
Cadmium	4.1 µg/L
Manganese	NE
Mercury	0.02 µg/L (w/DL = 0.64)
Selenium	8.2 µg/L
Thallium	NE
Zinc	411 µg/L
Volatile Organics	
Acetone	6,800 µg/L
Benzene	5 µg/L
2-Butanone	210 µg/L
Chloromethane	NE
1,4 – Dichlorobenzene	NE
1,1 – Dichloroethane	NE
1,2 – Dichloroethene – cis	70 µg/L
Ethylbenzene	34 µg/L
Methylene chloride	5 µg/L
Tetrachloroethene	5 µg/L
Trichloroethene	5 µg/L
Vinyl chloride	2 µg/L
4 – Methyl - 2 – pentanone	15 µg/L
Semi-Volatile Organics	
bis(2 – Chloroethyl) ether	9.6 µg/L
bis(2 – Ethylhexyl) phthalate	6 µg/L
Isophorone	50 µg/L
4 – Methylphenol	34 µg/L
Pentachlorophenol	1 µg/L
PCBs	
PCBs	0.00056 µg/L (w/DL = 0.1 to 0.9)

Notes:

NE = No effluent limit established.
DL = Detection limit
S.U = Standard pH units
µg/L = micrograms per Liter

Table 2

Closure Activities for Site Capital Tasks

Consent Decree EPA ID	Task Description	Construction Completion Year	Construction Completion Report (CCR) or Closure Activity
Capital Construction Activities			
I	**Site Preparation and Cleanup**		
1.a.	Close Firepond	2003	*Final PCB-Impacted Soil Excavation in the Wetland Area Construction Completion Report* (MWH, November 2002) and *Still Bottoms Pond Area Interim Engineered Cover Construction Completion Report Including Fire Pond Closure* (MWH, March 2003)
1.b.	Spoils Pile Consolidation	2001	*Final Off-Site Area Interim Engineered Cover Construction Completion Report Including Spoils Pile Consolidation* (MWH, February 2003)
1.c.	Drum/Waste Removal in On-Site Containment Area	2002	*Final Buried Drum Removal in the On-Site Containment Area Construction Completion Report* (MWH, March 2003)
1.d.	PCB Soil Excavation from Wetland	2001	*Final PCB-Impacted Soil Excavation in the Wetland Area Construction Completion Report* (MWH, November 2002)
1.e	General Groundwater Remediation		
1.e.1.	ORC Treatment of Groundwater in North Area	NA	A pilot study was conducted in the North Area in 1999 to evaluate the effectiveness of ORC treatment of groundwater in the North Area. The results of the pilot study are detailed in Agency-approved *ORC Pilot Study Report, Summary of the Oxygen Release Compound Pilot Study in the North Area (Montgomery Watson, November 2000)*
1.e.2.	ORC Treatment of Groundwater in South Area	2004	A pilot study was conducted in the South Area in 2001 to evaluate the effectiveness of ORC treatment of groundwater in the South Area. The results of the pilot study are detailed in *Final Phase 3 Investigation Report, South Area ORC Pilot Study* (MWH, April 2004)
2	**In-Situ Soil Vapor Extraction (ISVE)**		
2.a.	ISVE Installation - Off-Site Containment Area	2002	*Off-Site Containment Area and Kapica-Pazmey Area In-Situ Soil Vapor Extraction Systems Construction Completion Report* (MWH, March 2004)
2.b.	ISVE Installation - Kapica Pazmey Area	2002	*Off-Site Containment Area and Kapica-Pazmey Area In-Situ Soil Vapor Extraction Systems Construction Completion Report* (MWH, March 2004)
2.c.1.	O&M of Off-Site ISVE System for 1st 12 months	2003	Duration-based operating event. Therefore, no completion documentation is required.
2.c.2.	O&M of K-P Area ISVE System for 1st 12 months	2003	Duration-based operating event. Therefore, no completion documentation is required.
2.d.	ISVE Installation - Still Bottoms Pond Area	2003	*Still Bottoms Pond Area In-Situ Soil Vapor Extraction System Construction Completion Report* (MWH, June 2004)
2.e	O&M of Still Bottoms Pond System for 1st 12 months	2004	Duration-based operating event. Therefore, no completion documentation is required.
3 & 4	**De-Watering/Barrier Wall**		
3.a.	Groundwater Treatment Plant Upgrade	2000	*Operation & Maintenance Manual Groundwater Treatment Plant* (MWH, July 2002)
3.b.1.	Barrier Wall Extraction System Upgrades Off-Site	2001	*Final Barrier Wall Extraction System, Off-Site Area Upgrades Construction Completion Report* (MWH, March 2003)
3.b.2.	Barrier Wall Extraction System Upgrades On-Site	2003	*Still Bottoms Pond Area In-Situ Soil Vapor Extraction System Construction Completion Report* (MWH, June 2004) and *Still Bottoms Pond Area Interim Engineered Cover Construction Completion Report Including Fire Pond Closure* (MWH, March 2003)
3.c.	De-Watering Groundwater Treatment System	NA	This item is not included in Appendix G of the Consent Decree as a required capital construction item. This item was added as an accounting method to track contingency costs associated with task-specific dewatering needs.
4.a.	Barrier Wall Between On-Site and Off-Site Areas	2001	*Separation Barrier Wall Construction Completion Report* (MWH, March 2002)
5	**Cap/Cover**		
5.a.	Temporary Off-Site Area	2001	*Final Off-Site Area Interim Engineered Cover Construction Completion Report Including Spoils Pile Consolidation* (MWH, February 2003)
5.b.	Final Off-Site Area	2003	*Off-Site Area Final Engineered Cover Construction Completion Report* (MWH, June 2004)
5.c.	Temporary On-Site Area	2003	*Still Bottoms Pond Area Interim Engineered Cover Construction Completion Report Including Fire Pond Closure* (MWH, March 2003)
5.d.	Final On-Site Area	2004	*Still Bottoms Pond Area Final Engineered Cover Construction Completion Report* (MWH, January 2005)

Notes:

1 This list contains only the capital tasks identified in the Consent Decree and subsequently the only tasks that need to be completed for total construction completion of the Final Remedy.

Table 3

Completion of Punch List Items

Task ID	Punch List Item [1]	Completion Summary
1.e General Groundwater Remediation	1. Complete restoration of the property at 1002 Reder Road as part of Phase 1 Chemical Oxidation Application.	Restoration at 1002 Reder Road was completed in October 2004. Restoration consisted of smoothing ruts and torn-up areas, seeding areas with grass. Similar restoration activities were performed following subequent injection events.
	2. Complete chemical oxidation injection at the remaining 65 points of the Phase 1 Application.	The Phase 1 chemical oxidation application was completed on September 25, 2004.
	3. Demobilize equipment from Phase 1 Chemical Oxidation Application.	The chemical oxidation injection equipment was demobilized from the site on September 25, 2004.
	4. Complete indoor air intrusion follow-up work at the residence at 1002 Reder Road.	Soil vapor sampling was conducted in August 2004 and documented in a February 7, 2005 letter report. A Soil Vapor Mitigation System was installed at the residence in February 2005. Indoor air sampling was conducted in June 2005. Sampling results show that no further action is required.
5.d Final On-Site Cover	1. Dress up the edges of the cover with aggregate to assist in directing stormwater to the catch basins and protect the edges of the cover.	INDOT Aggregate #53 was placed along the cover in selected areas on October 8, 2004.
	2. Place regular asphalt around select catch basins around the perimeter of the cover to assist in directing stormwater to the catch basins.	Asphalt was placed around the selected catch basins on October 8, 2004.
	3. Install an asphalt curb along certain locations at the south perimeter of the cover to assist in directing stormwater to the catch basins	The curb was installed at selected locations on October 8, 2004.
	4. Evaluate if additional work needs to be completed to address the areas where stormwater ponds on the cover.	Due to the relatively small and shallow nature of the ponding areas and the potential for damaging the newly installed cover to repair them, no action is recommended.
	5. Expand the fencing to include more ISVE wells.	The fencing on the east side of the truck road was completed in March 2005.
	6. Mark the allowed truck route on the cover.	The extents of the truck route were painted on the asphalt on October 21, 2004.

Note:

[1] Punch list items identified by the EPA and IDEM during the Pre-Final Inspection on September 23, 2004.

Appendix A

Acronyms and Abbreviations

ACS	American Chemical Service
amsl	Above Mean Sea Level
AS	Air Sparge
BOD	Biological Oxygen Demand
BWES	Barrier Wall Extraction System
CCR	Construction Completion Report
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cfm	Cubic feet per minute
cm/s	Centimeters per second
CQAP	Construction Quality Assurance Plan
DL	Detection Limit
DPE	Dual Phase Extraction
ESD	Explanation of Significant Differences
FML	Flexible Membrane Liner
FS	Feasibility Study
FSP	Field Sampling Plan
GWTP	Groundwater Treatment Plant
HDPE	High Density Polyethylene
IDEM	Indiana Department of Environmental Management
IAC	Indiana Administrative Code
IDW	Investigation Derived Wastes
ISCO	In-Situ Chemical Oxidation
ISVE	In-Situ Soil Vapor Extraction
K-P Area	Kapica-Pazmey Area
lb/day	Pounds per day
LTTT	Low Temperature Thermal Treatment
MATCON	Modified Asphalt Technology for Waste Containment
mg/kg	Milligrams per kilogram
MNA	Monitored Natural Attenuation
MWH	Montgomery Watson Harza (formerly Warzyn and Montgomery Watson)
NAPL	Non-Aqueous Phase Liquid
NPL	National Priorities List
O & M	Operations and Maintenance
OFCA	Off-Site Containment Area
ONCA	On-Site Containment Area
ORC	Oxygen Reduction Compound
OSHA	Occupational Safety and Health Administration

Appendix A (continued)

Acronyms and Abbreviations

PCBs	Polychlorinated Biphenyls
PCOR	Preliminary Close-out Report
PGCS	Perimeter Groundwater Containment System
ppm	Parts per million
PRP	Potentially Responsible Parties
PSVP	Performance Standard Verification Plan
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SBPA	Still Bottoms Pond Area
SOW	Statement of Work
SSP	Site Safety Plan
SVOC	Semi-Volatile Organic Compounds
TCL/TAL	Target Compound List/Target Analyte List
TSCA	Toxic Substances Control Act
TSS	Total Suspended Solids
µg	Micrograms
µg/L	Micrograms per liter
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

Appendix B
Remedial Construction Timeline

Consent Decree	Task Description Capital Construction Activities
	Interim Remedial Actions
	Construct PGCS
	Construct Barrier Wall
	Construct BWES
	GWTP Construction
1	**Site Preparation and Cleanup**
1.a.	Close Firepond
1.b.	Spoils Pile Consolidation
1.c.	Drum/Waste Removal in On-Site Containment Area
1.d.	PCB Soil Excavation from Wetland
1.e	General Groundwater Remediation
1.e.1.	ORC Treatment of Groundwater in North Area
1.e.2.	ORC Treatment of Groundwater in South Area
2	**In-Situ Soil Vapor Extraction (ISVE)**
2.a.	ISVE Installation - Off-Site Containment Area
2.b.	ISVE Installation - Kapica Pazmey Area
2.c.1.	O&M of Off-Site ISVE System for 1st 12 months
2.c.2.	O&M of Kapica Area ISVE System for 1st 12 months
2.d.	ISVE Installation - Still Bottoms Pond Area
2.e.	O&M of Still Bottoms Pond System for 1st 12 months
3 & 4	**De-Watering/Barrier Wall**
3.a.	Groundwater Treatment Plant Upgrade
3.b.1.	Barrier Wall Extraction System Upgrades Off-Site
3.b.2.	Barrier Wall Extraction System Upgrades On-Site
4.a.	Barrier Wall Between On-Site and Off-Site Areas
5	**Cap/Cover**
5.a.	Temporary Off-Site Area
5.b.	Final Off-Site Area
5.c.	Temporary On-Site Area
5.d.	Final On-Site Area
	Operation & Maintenance
B.1,2,3,4	PGCS Groundwater Treatment System
B.1,2,3,4	ISVE System Monitoring
B.6.	Monitored Natural Attenuation